

THE BEEF NUTRIENT DATABASE IMPROVEMENT PROJECT: RETAIL CUTS
FROM THE CHUCK

A Thesis

by

SARAH ELIZABETH WEST

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2009

Major Subject: Animal Science

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Approved by:

Co-Chairs of Committee, Jeffrey W. Savell
Kerri B. Harris

Committee Member, R. Daniel Lineberger
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ABSTRACT

The Beef Nutrient Database Improvement Project: Retail Cuts

From the Chuck. (May 2009)

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Co-Chairs of Advisory Committee: Dr. Jeffrey W. Savell
Dr. Kerri B. Harris

A total of 40 beef arm chucks were collected from three cities across the United States to study the proximate composition of their separable lean. Chucks were fabricated 5-7 d postmortem and later cooked and dissected, or dissected raw into four separable components, separable lean, external fat, separable seam (intermuscular) fat, and connective tissue (considered inedible). Proximate analysis was conducted on the separable lean component of each dissected retail cut.

Dissection data showed that multiple muscled cuts had a numerically lower percent separable lean when compared to the retail cuts comprised of a single muscle. Proximate analysis showed that as the mean value for moisture decreased in the retail cut, the mean percentage of total fat increased. Least squares means of total fat percentage were reported on the retail cuts stratified by USDA quality grade (upper Choice, lower Choice, and Select). Some of the retail cuts had significantly different total fat percentage of the separable lean when considering the differences in USDA quality grade. Cooking yields for the three methods utilized were numerically different. The cuts that were roasted had the highest cooking yield (80.72 %), followed by cuts that

were grilled (76.58%), and finally cuts that were braised (66.13%). Differences in final endpoint temperature for each cut may account for the differences between cooking methods.

This study was designed to acquire data to update the National Nutrient Database for Standard Reference, as well as to provide nutritional information for cuts that are not presently in the database. This study evaluated thirteen cooked cuts and twelve raw cuts in an effort to increase the number of retail cuts available to search for nutrient information in the National Database.

DEDICATION

To my mother and father, Ira and Rebecca West. Thank you for this wonderful life. Thank you for all of the memories. Thank you for my education.

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I will start by thanking my committee chair, Dr. Jeff Savell, for his support, encouragement, and faith in me during my time in graduate school. I have learned so much from him over the past few years. His character, strength, faith, and humility were inspiring beyond belief. I have to also take this opportunity to thank him eternally for accepting me into this program. I am forever grateful for the chance he took on me, and the opportunity he gave me. Being an Aggie has been a dream of mine, and he made it a reality. I will also thank my committee co-chair, Dr. Kerri Harris for her constant guidance during the course of this project. Her strength and poise were inspiring. I am so pleased to have had her as a mentor and teacher during the past two years. Finally, many thanks to Dr. Dan Lineberger for his support throughout the course of my education and this research. I truly enjoyed having him as a professor in the classroom. His love of Aggie athletics was a passion that I too share.

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This study is a collaboration between the Nutrient Data Laboratory, National Cattlemen's Beef Association, Texas Tech University, Colorado State University, and Texas A&M University. Under this umbrella, there are numerous people that I must thank for their help and expert advice. Thank you Dr. Jennifer Leheska and Dr. Shalene McNeill for your friendship and guidance during this project. It was a pleasure meeting both of you, and I am grateful for what you are doing for the beef industry, and I was so glad to be of assistance. Thank you Dr. Chance Brooks, Dr. Leslie Thompson, Jenna Pool, Anna Luna, Dr. Keith Belk, and Jennifer Shutz for your help during the collaboration. Finally, I must thank Dr. Larry Douglass, Sue Douglass, Juliette Howe, and Kris Patterson for their expert advice and support during the long days of data collection. This project was funded, in part, by the beef checkoff, for the Cattlemen's Beef Board and the National Cattlemen's Beef Association.

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CHAPTER I

INTRODUCTION

The USDA National Nutrient Database for Standard Reference (National Database) provides data for national nutrition policies, diet therapy, nutrition education programs, guidance for pediatric, obstetric, and geriatric populations, as well as a source of information for menu calculations for schools, nursing homes, and hospitals (USDA, 2008). Information in the National Database also is used to provide nutrition information for on-pack labeling of nutrient claims. Because such a large number of people rely on these data, it is imperative the information be current and accurate. The USDA's most commonly used database, Agriculture Handbook No. 8, "Composition of Foods: Beef Products; Raw, Processed Prepared," was first prepared in 1950 and has undergone four revisions (NCBA, 2005). In the early 1980s, Agriculture Handbook 8-13 (AH 8-13), as it is commonly referred to, was using fat trim levels that dated back to 1963 data. Research conducted in the 1980s and 1990s worked to update much of the information in the database when reports from Cross, Savell, and Francis (1986) showed that consumers preferred beef retail cuts that were trimmed to have little or no fat (Savell et al., 1989).

Studies conducted in the early 1960's poorly predicted the percentage of fat and calories of beef products because they had not adjusted these data for any trimming of external fat (NCBA, 2005). Gerber, Scheeder, and Wenk (2009) reported that the

This thesis follows the style of *Meat Science*.

nutrients in meat are significantly affected by cooking and trimming, and when nutrient information is estimated, this must be taken into account. Unfortunately, even though USDA has made changes to the nutrition information through research, some institutions still used the antiquated data for nutrition computations. One study, van Heerden and Schönfeldt (2004), reported that food and nutrition have a growing importance for public health for all both developing and developed countries. Southern Africa is in need of up-to-date food composition tables to help their population fight diseases related to nutrition including malnourishment, iron deficiency, and even obesity due to rapid urbanization (van Heerden & Schönfeldt, 2004). They also reported that the tables of South Africa, which were compiled by the Medical Research Council, were redesigned using data from the United States Department of Agriculture (USDA) that dated back to the research conducted in 1963 (van Heerden & Schönfeldt, 2004). This illustrates why the industry must keep the information current and accurate so that others may optimally use the data as well.

At the time of the first National Beef Market Basket Survey (1987-1988) AH 8-13 was using data based on a retail fat trim level of 1.27 cm. The National Beef Market Basket Survey (Savell, Harris, Cross, Hale, & Beasley, 1991) concluded that the mean trim level on retail cuts was actually 0.31 cm, while over 42% of the cuts surveyed were completely trimmed of external fat. Also, ground beef in the retail marketplace contained 10% less fat than reported in AH 8-13. Following this study, Jones, Savell, and Cross (1992a, b, c) evaluated separable components, fat and moisture content of the

separable lean, and cooking yields and fat retentions on beef retail cuts. These data were used to update AH 8-13. The National Beef Tenderness Survey-1998 revealed that trim levels were continuing to decrease (Brooks et al., 2000) and more research was initiated at Texas A&M University to address differences in trim levels and cooking methods on separable components (Wahrmund-Wyle, Harris, & Savell, 2000 a,b), which was added to AH 8-13 (ultimately AH 8-13 became known as the National Database). The 2005 National Beef Market Basket Survey collected 1,551 retail cuts from eleven cities across the US to get a sense of the physical and chemical composition of the retail cuts in the marketplace (Mason et al., 2008). Because so many of the retail cuts in stores are not represented in the National Database, the Beef Nutrient Database Improvement Project was born.

The 2005 National Beef Market Basket Survey Executive Summary called for the need to update nutrition information (NCBA, 2005). It reports that health professionals and consumers commonly associate the nutritive value of beef as too fat. Often that assumption associates beef with an unhealthy amount and type of fat. This research provides data for beef cuts that are most often marketed in the retail case, and missing from the database. After the information collected in this project is updated, other nutrient databases that use the National Database as a reference point also will have access to the most up-to-date nutrient data.

This project is a collaboration between Texas A&M University, Texas Tech University, Colorado State University, the National Cattlemen's Beef Association, and the Nutrient Data Laboratory. The findings presented in this thesis are the result of data

that were collected only by Texas A&M University. After each university has completed their portion of the project, the information collected will be combined and presented in the National Database.

CHAPTER II

REVIEW OF LITERATURE

There is a national confusion of lean beef's actual fat composition. Red meat commonly has been published as a fatty food, and this misunderstanding raises serious concerns for consumers (Harrington, 1994). The current data used to calculate the nutrient content of beef are outdated. The nutrient content of whole muscle meat has changed due to improvements in production practices, age of animal at harvest, variation due to breed type, and retail trends. Gerber, Scheeder, and Wenk (2009) reported that meat suffers a bad image, and the fact that meat contains many essential nutrients is often overlooked. This image has caused consumers to consume less red meat instead of just avoiding the high-fat meats they have been taught to keep away from (Swize, Harris, Savell, & Cross, 1992). Also, nutrient intake of meat is affected to different degrees by cooking and trimming (Gerber et al., 2009). Most of the world's population consumes red meat, and it is important that there is accurate information to educate people about lean beef, trimmed of fat (Harrington, 1994).

Concerns about the amount of fat in the diet have prompted the industry to provide leaner beef cuts (Goehl, Harris, Savell & Cross, 1992; Jones, Savell, & Cross, 1992a). The National Beef Tenderness Survey-1998 showed that trim levels continued to decrease in the retail case (Brooks et al., 2000). The National Market Basket Survey-2005 found that more external fat is trimmed from retail cuts than in previous years (Mason et al., 2008). Trimming external fat before cooking can lower total fat intake

(Smith, Savell, Smith, & Cross 1989), total calories, calories from fat, and total cholesterol intake (Swize et al., 1992). Wahrmond-Wyle et al. (2000 a,b) studied thirteen cuts from the carcass and assigned multiple treatments of trim levels and cooking methods. They reported that the lipid content for most cuts in the study were lower than the values that were currently reported in the Agriculture Handbook 8-13 (Wahrmond-Wyle et al., 2000b). Mason et al. (2009) reported data on many cuts that are not even present in the database. In the Executive Summary for the 2005 National Beef Market Basket Survey, Dr. Jeff Savell, PhD., Texas A&M University, noted that the beef retail case carries products that are notably superior in nutrition than products of the past. He urged the national databases to keep up with this progress (NCBA, 2005).

This phase of the project deals solely with the beef chuck. It is the priority primal for the carcass due to an increasing demand of new cuts being fabricated from the beef chuck. Earlier this decade, the beef industry began to take notice of substantial differences in value between the round, loin, rib, and chuck. Savell and Smith (2009) determined the percentage of each primal cut of a USDA Choice carcass to be 24% round, 17% loin, 9% rib, 30% chuck, and 20% of the carcass was brisket, plate, shank, and kidney and pelvic fat. The valued rib and loin only make up 26% of the carcass (Molina, Johnson, West, & Gwartney, 2005). Von Seggern, Calkins, Johnson, Brickler, and Gwartney (2005) report that in the mid-1990s the wholesale value of the beef chuck, round and trimmings decreased approximately 25% while the wholesale value of the rib and loin increased 3-5%. Molina et al. (2005) also reported that the main reason so much value is associated with the rib and loin is because of the quality perception that

these cuts are far superior to those from the chuck and round. The Bovine Myology (Jones, Burson, & Calkins, 2001) and Muscle Profiling Studies (Von Seggern et al., 2005) were conducted in an attempt to better understand some of the individual muscles of the chuck and round. These studies identified multiple muscles that reported desired palatability.

Research conducted at Texas A&M University by Pfeiffer, Voges, King, Griffin, and Savell (2005) revealed innovative carcass fabrication to offer greater merchandising opportunities and improve value by improving yields of subprimals and retail cuts. Comparisons of a conventional and innovative method of fabrication showed that carcass value increased by greater than \$14 USD per head, and yields of subprimals were equal or greater for the innovative style (Pfeiffer et al., 2005).

The beef innovations group of the National Cattlemen's Beef Association has launched the Beef Value Cuts page as part of their Website (NCBA, 2009a). They address the need to add value to the chuck and round through innovative fabrication. Their Website teaches these styles to retailers through schematics, step by step instructions, cutting videos, and an error guide. They report that in the US between 2001 and 2006 the number of retailers offering one or more value cuts increased from 1,000 to 9,000 (NCBA, 2009a). Mueller, King, Baird, McKenna, Osburn, and Savell (2006) report that the industry is shifting towards merchandising strategies for the underutilized round and chuck.

CHAPTER III

MATERIALS AND METHODS

3.1. Product selection

Beef chucks (n=40) were collected from three plants across the country (Green Bay, Wisconsin; Tolleson, Arizona; and Corpus Christi, Texas). Carcasses were selected according to a sampling matrix determined for the study (Table 1). Sex class, USDA quality grade, yield grade, weight, and genetics were all criteria set in the study to best represent animals found in the US food supply. Additional criteria included that the carcass must be free from slaughter and dressing defects such as incorrect carcass splits, large bruises, a calloused eye, or major fat tears. Carcass data were collected on each carcass selected for this study (Table 2). The carcasses were tagged, followed through fabrication, and the chucks were collected in combos. They then were shipped via refrigerated truck to the Rosenthal Meat Science and Technology Center at Texas A&M University and stored (0-4 °C) until fabrication.

3.2. Fabrication

Chucks were fabricated 5-7 d postmortem into retail cuts (Table 3). Chucks were fabricated following the study protocol. At the fabrication step, trained assistants started with an intact Beef Arm Chuck. It was placed on the cutting table with the external surface down. The brisket was removed by sawing through the costal cartilage and ribs,

through the tip of the deep pectoral. The cut was finished by pulling on the posterior end of the brisket and peeling it off the arm. The brisket was left practically free of deckle fat. The forelimb of the chuck was suspended and the neck and ribs were removed in one intact piece. One pound of beef for stew was generated from the neck muscles, and one pound of stew was generated from the remaining deep pectoral. The boneless chuck roll complex was removed and used to generate boneless chuck short ribs, chuck-eye steaks, country-style ribs, the America's roast, Denver steaks, and under blade steaks and roasts. The supraspinatus was removed off the ridge of the scapula to generate mock tender steaks. The scapula was removed, followed by the infraspinatus to generate top blade steaks. The shoulder clod then was pulled to generate beef shoulder steaks, and two shoulder clod roasts.

Retail cuts were vacuum packaged, boxed, and stored in a cooler (0-4 °C). Retail cuts were transferred to a -18 °C freezer 21 d postmortem. Ten carcasses were collected according to the study sampling matrix. A second set of ten carcasses were selected as a pair to the first ten. Retail cuts from the right side of each carcass were assigned to the cooked treatment, and those from the left side of the carcass were assigned to the raw treatment.

3.3. Dissection

Dissection was conducted following procedures outlined in the study protocol. Trained dissectors opened and drained the purge from the vacuum packaged retail cuts and the initial cut weight was recorded. Internal temperature of the cut was recorded

prior to dissection. Retail cuts were dissected into separable lean, separable fat, and refuse. Following the procedures in Wahrmund-Wyle et al. (2000a), separable lean included all muscle, intramuscular fat, and any connective tissue trained dissectors considered edible. After each dissection, technicians recorded the weights of all dissected components ensuring a 99% recovery of each initial cut weight. Lean components were bagged in gallon size Ziploc® bags, labeled, and refrigerated for same day homogenization. Seam fat was put in a WhirlPak® bag, vacuum packaged, and frozen (-18 °C) for later sample compositing.

3.4. Cooking

Cooking method of braised, grilled, or roasted was assigned to the retail cuts that were designated for the cooked treatment (Table 3). For all cook methods, samples were thawed in refrigeration (0-4 °C) for 24-48 h. Tempering start and stop time, date, cooler temperature, and location in cooler were all recorded. Internal temperature was not to exceed 5 °C prior to cooking. A thermocouple was placed in the geometric center or thickest portion of the retail cut and cooked to a final endpoint temperature depending on cooking method. After cooking, samples were chilled in refrigeration (0-4 °C) uncovered for 12-24 h post-cooking in preparation for dissection.

The braising method of cooking was achieved by pre-heating a Calphalon® Everyday Nonstick 6-Quart Dutch oven at medium heat (177 °C). An infrared thermometer was used to check and record the pan surface temperature. Beef samples then were browned in the Dutch oven, and any pan drippings were collected and their

volume was recorded. Distilled, de-ionized water was added at a volume that reached one-third of the thickness of the meat, and that volume was recorded. Liquid was brought to a boil, the pan was covered, and the Dutch oven was placed in a pre-heated conventional oven (120 °C), and the samples simmered until they reached an internal temperature of 85°C. The Dutch oven was removed from the oven and the internal temperature of the samples was monitored as it rose until a point of decline. Final internal temperature of the retail cut was recorded with the corresponding time.

Grilling was performed on a Salton two-sided electric grill with removable plates (Grill Model No. GRP00, Salton, Inc., Lake Forest, Illinois). Grills were preheated to a surface temperature of 195 °C. An infrared thermometer was used to check and record the grill surface temperature. Beef samples were arranged on the grill, evenly spaced, and the grill lid was closed. Product was cooked to an internal temperature of 70 °C. Beef samples were removed from the grill and allowed to stand until final internal temperature was reached.

Roasting consisted of pre-heating the conventional oven to a temperature of 160 °C. An infrared thermometer was used to check and record the oven temperature. Beef samples were placed in a Calphalon® Non-stick roasting pan with rack in the center of the oven. Samples were roasted to an internal temperature of 60 °C. Final internal temperature of the retail cut was recorded with its corresponding time.

3.5. Homogenization

Beef samples (cooked and raw) were homogenized using a Robot Coupe Blixer 7 BX 6V (Robot Coupe USA, Inc., Ridgeland, Mississippi) batch processor following dissection. The separable lean from the sample was cut into 2.5 cm pieces. Samples were placed in liquid nitrogen until completely frozen. Pieces were transferred to the Robot Coupe 7. The sample was blended at 1500 rpm for 10 seconds, sides of the bowl were scraped, and the sample then was blended at 3500 rpm for 30 seconds. After homogenization, 60 g of powder was placed into a Whirlpak® bag for proximate analysis and 100 g was placed into a Whirlpak® bag as a backup sample. The remaining powder was transferred into a Ziploc® freezer bag, weighed, and double-bagged for nutrient analysis. All samples were stored in a -80°C freezer.

3.6. Proximate analysis

Percentage of moisture was determined using AOAC (1990) air, oven-dry method 950.46. Approximately 5 g of powdered sample from each cut and animal was added to dried, pre-weighed aluminum tins and weights recorded. Analysis of the samples was performed in triplicate. Samples were oven dried at 100 °C for 16-18 h then removed and placed in a desiccator for cooling. Weights were recorded. Percentage of moisture was calculated by taking the initial weight of the sample, subtracting the dried weight, dividing by the initial weight and multiplying by 100.

Nitrogen content of the powdered beef samples was determined by total combustion (Rapid N Cube; Elementar, Hanau, Germany). Before analysis, three blank

standards of aspartic acid were used to calibrate the machine. Approximately 250 mg of sample was weighed into a foil weigh sheet and a pellet was made, weighed, and the weight was entered into the machine. Crude protein levels were determined by multiplying the total nitrogen by a factor of 6.25.

Percentage of ash was determined using the ash oven method 920.153 AOAC (1990). Samples that were dried for moisture analysis were used following moisture determination. Samples were placed in the muffle furnace. The samples were run at a temperature of 600 °C for 10 hours and 28 minutes. Samples were removed, and placed in a desiccator to cool to room temperature prior to recording a final sample weight. Loss in weight was used to calculate ash.

Total lipid was extracted using a modified Folch, Lees, and Stanley (1957) method. Samples weighing approximately 0.5 g were homogenized with 20 mL chloroform: methanol (2:1). The homogenate was filtered through a funnel with slight suction into a clean test tube. The filtrate received 8 mL of a 0.74% KCl solution. The two phases were separated in a centrifuge for 20 min. The upper phase was siphoned off and the lower phase was transferred into pre-dried, pre-weighed 100 mL glass scintillation vials. The lower phase was evaporated using a nitrogen gas evaporator and a 70 °C water bath. Samples then were dried for 20 min at 100 °C, cooled in a desiccator, and weighed to calculate total fat.

3.7. Fat retention

Fat retention values were determined for each retail cut using raw versus cooked data, and expressed using the following equation derived from Murphy, Criner, and Gray (1975), and used by Jones et al. (1992b) and Wahrmund-Wyle et al. (2000b).

$$\text{Percentage fat retention} = (\% \text{ fat in the cooked lean}) / (\% \text{ fat in the raw lean}) \times \text{cooking yield.}$$

3.8. Statistical analysis

Means, standard deviations, and percentage values were computed using data analysis functions in Microsoft Excel (Microsoft Corporation, Redmond, Washington). Mean separation by USDA quality grade for each retail cut was conducted for significance between treatments using PROC GLM with Pdiff option (SAS Institute, Cary, North Carolina).

CHAPTER IV

RESULTS AND DISCUSSION

4.1. Separable tissue components of raw and cooked retail cuts

Retail cuts in this study were dissected into three separable components, separable lean, seam fat, and connective tissue considered inedible. Table 4 and 5 report means and standard deviations for the separable components of raw and cooked retail cuts, respectively. Retail cuts that are comprised of multiple muscles, such as the chuck-eye steak (76.33 % separable lean, raw), have numerically lower percentages of separable lean than retail cuts that are derived from a single muscle, like the mock tender steak (95.96 % separable lean, raw). This is because the intermuscular (seam) fat is removed during dissection from in between muscles. The exception to this is the top blade steak, which is a single muscle cut, comprised only of the *M. infraspinatus*. This cut has a large sheet of connective tissue which was removed during dissection, resulting in a mean value for separable lean, raw, of 86.16 %. Separable components were analyzed using least squares means of the percent lean, percent separable fat, and percent inedible connective tissue, stratified by USDA Quality Grade for raw and cooked retail cuts. For the raw retail cuts, USDA Quality Grade did not account for differences for any of the separable components within any retail cuts. The clod steak was the only cooked retail cut that reported significant differences for separable components among USDA Quality Grade. Percentage separable lean and percentage inedible connective tissue for the lower Choice steaks was 97.81 % and 1.57 %, respectively, and percentage separable

lean and percentage inedible connective tissue for the Select steaks was 98.86 % and 0.93 %, respectively.

4.2. Proximate analysis of the separable lean

Percent total chemical fat, moisture, protein, and ash analyses were conducted on the separable lean component obtained from the dissection of each retail cut. Means and standard deviations for the percentage of each component for raw and cooked retail cuts are presented in Tables 6 and 7, respectively. Mean percentage of moisture decreased as the mean percentage of total fat increased. Jones et al. (1992b), Wahrmond-Wyle et al. (2000b), and Mason et al. (2008) all reported parallel findings. Similarly, after cooking the retail cut, the percentage moisture decreased and the percentage of total fat, protein, and ash increased due to a loss of moisture as a result of cooking.

Table 8 and 9 report the least squares mean of total chemical fat (%) of the separable lean of the beef retail cuts stratified by USDA quality grade. Currently, USDA reports nutrient values for cuts in three different categories, choice, select, and all grades. Some of the retail cuts in this study report significantly different values for percent chemical fat in the separable lean when sorting cuts based on USDA quality grade. This suggests that the National Database continue this method of reporting nutrition values based on USDA quality grade for retail cuts.

4.3. Cooking yields of beef retail cuts

Cooking yields of the beef retail cuts are shown in Table 10. The America's roast had the highest cooking yield, and was the only cut assigned to the roasting treatment. The cuts assigned to the grilled method of cooking followed with slightly lower cooking yields. The cuts that were braised exhibited the lowest cooking yields. Similar conclusions were made by Jones et al. (1992b) and Wahrmond-Wyle et al. (2000a). Cuts that are roasted tend to have higher cooking yields than cuts that are braised. Neither study used grilling as a cooking method. Cooking yield differences may be due to differences in final endpoint temperature assigned to each cooking method (Wahrmond-Wyle et al., 2000b), which were braising, 85 °C, grilling, 70 °C, and roasting, 60 °C.

4.4. Fat retention of the separable lean

Table 11 reports the percentage of chemical fat retention of the separable lean. In theory, single muscle cuts that are trimmed to have no external fat should have a fat retention value less than 100% because there should be no seam fat to migrate into the lean during cooking. However, our data were not consistent with this theory. The mock tender steaks reported 111.09 % chemical fat retention. Fat migration into the lean from seam fat into some of the retail cuts was observed in this study. Goihl et al. (1992) reported that the fat retentions that are greater than 100% may be influenced by moisture lost during cooking which concentrates the fat in the separable lean. Jones et al. (1992c)

conclude that consumers who would like to reduce fat intake should trim cuts prior to cooking rather than after.

4.5. Comparisons between data found in the National Database, 2005 National Market Basket Survey, and this study

The primary objective of this study was to collect data to be used in collaboration with research simultaneously conducted at Texas Tech University, Colorado State University, and USDA contracted labs to update and enhance the current data that is used to calculate nutrition information for beef retail cuts consumed in the United States. The data that are currently reported in the National Database have been derived from regression equations from Jones et al. (1992b,c) and actual means from Wahrmond-Wyle et al. (2000b). A number of cuts that were fabricated and collected for this study are not even present in the National Database, so comparisons could not be made. Table 12 compares the raw data collected from this study with values that were reported by Mason et al. (2008) and the current data in the National Database. It is evident that the retail cut composition in this country is not stagnant, but constantly changing. Table 13 compares the data collected in this study for cooked retail cuts with data in the National Database. Tables 12 and 13 are both evidence that the National Database is lacking in the number of retail cuts that it is reported for consumers to search.

CHAPTER V

CONCLUSIONS

The 2005 National Market Basket Survey (Mason et al., 2008) not only gave us more accurate data about trim levels and fat content of beef sold at market, it also gave us a picture of retail cuts present in the United States. That research illustrated the great need to introduce cuts that are found in US markets into the National Database. As the industry continues to develop innovative retail cutting methods and as improvements in production practices continue, it is imperative the National Database continues to survey the composition of retail cuts found in the market and update the nutrition information.

Currently, The National Cattlemen's Beef Association reports that there are 29 cuts of beef considered lean by government guidelines (NCBA, 2009b). Government guidelines report that a serving is considered lean if it has less than 10 g total fat, 4.5 g or less saturated fat and less than 95 mg cholesterol per 100g serving. Hopefully, data collected during the course of this research will lengthen the list of lean beef cuts available to consumers to incorporate as part of a healthy diet.

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APPENDIX A

Table 1
Packing plant location and animal assignments

| City | Weight (kg) | Quality grade | Yield grade | Gender | Genetics |
|----------------|-------------|---------------|-------------|--------|-----------|
| Green Bay | 318-408 | Upper Choice | 2 | Steer | Dairy |
| Green Bay | 295-385 | Upper Choice | 3 | Heifer | Non-dairy |
| Green Bay | 295-385 | Lower Choice | 2 | Heifer | Non-dairy |
| Green Bay | 318-408 | Lower Choice | 3 | Steer | Dairy |
| Green Bay | 318-408 | Select | 2 | Steer | Non-dairy |
| Corpus Christi | 318-408 | Upper Choice | 3 | Steer | Non-dairy |
| Corpus Christi | 295-385 | Lower Choice | 3 | Heifer | Non-dairy |
| Corpus Christi | 295-385 | Select | 2 | Heifer | Non-dairy |
| Tolleson | 318-408 | Lower Choice | 2 | Steer | Dairy |
| Tolleson | 318-408 | Select | 3 | Steer | Dairy |

Table 2

Carcass data collected on each animal selected for this study

| City | Carcass weight (kg) | Rib-eye area (cm ²) | Fat thickness (cm) | Yield grade | Marbling score ^a |
|----------------|---------------------|---------------------------------|--------------------|-------------|-----------------------------------|
| Green Bay | 354.0 | 76.8 | 0.5 | 2.7 | Md ³⁰ |
| Green Bay | 332.7 | 78.1 | 1.9 | 3.3 | Mt ⁷⁰ |
| Green Bay | 325.0 | 81.3 | 1.3 | 2.8 | Sm ³⁰ |
| Green Bay | 344.3 | 72.9 | 0.9 | 3.0 | Sm ⁵⁰ |
| Green Bay | 384.7 | 91.6 | 0.6 | 2.0 | Sl ⁸⁰ |
| Green Bay | 377.6 | 78.7 | 0.7 | 2.7 | Md ¹⁰ |
| Green Bay | 360.4 | 92.3 | 1.9 | 3.1 | Mt ⁹⁰ |
| Green Bay | 341.3 | 87.1 | 1.0 | 2.4 | Sm ¹⁰ |
| Green Bay | 368.1 | 68.4 | 0.5 | 3.1 | Sm ⁷⁰ |
| Green Bay | 395.8 | 103.9 | 2.0 | 2.6 | Sl ⁷⁰ |
| Corpus Christi | 293.5 | 81.3 | 1.4 | 3.0 | Mt ⁵⁰ Mt ⁸⁰ |
| Corpus Christi | 310.9 | 83.9 | 1.1 | 2.7 | Sm ⁴⁰ Sm ³⁰ |
| Corpus Christi | 319.6 | 77.4 | 1.1 | 2.8 | Sl ²⁰ Sl ²⁰ |
| Corpus Christi | 362.2 | 80.0 | 1.4 | 3.3 | Mt ²⁰ Mt ²⁰ |
| Corpus Christi | 298.0 | 89.0 | 0.8 | 2.0 | Sm ⁴⁰ Sm ³⁰ |
| Corpus Christi | 346.1 | 96.8 | 1.5 | 2.4 | Sl ⁷⁰ Sl ⁴⁰ |
| Tolleson | 373.8 | 80.6 | 0.6 | 2.8 | Sm ¹⁰ Sm ²⁰ |
| Tolleson | 324.8 | 71.0 | 0.8 | 2.9 | Sm ³⁰ Sm ²⁰ |
| Tolleson | 332.0 | 68.4 | 0.8 | 3.2 | Sl ⁴⁰ Sl ³⁰ |
| Tolleson | 350.2 | 78.1 | 0.6 | 3.0 | Sl ¹⁰ Sl ¹⁰ |

^aThe Green Bay collection reported marbling score as an average of the two sides. Later collections reflected the marbling of both sides separately.

Table 3
Retail cuts fabricated for the study along with cook method, if applicable

| Cut name | UPC ^a | Cooking method |
|-----------------------|------------------|----------------|
| Brisket ^b | 1615 | |
| Shoulder (clod) roast | 1132 | Braised |
| Shoulder (clod) steak | 1133 | Grilled |
| Beef for stew | 1727 | Braised |
| Denver cut | | Grilled |
| Country style ribs | | Braised |
| America's roast | | Roasted |
| Chuck-eye steak | 1102 | Grilled |
| Under blade roast | 1151 | Braised |
| Under blade steak | 1158 | Braised |
| Top blade steak | 1144 | Grilled |
| Mock tender steak | 1116 | Braised |
| Short ribs | 1127 | Braised |

^aUniversal Product Code

^bThe beef brisket was left whole until the dissection phase of the project, where it was separated into the point half (UPC^a 1628) and flat half (UPC^a 1623), and each component was dissected separately. Proximate analysis was performed on the flat half, raw, only.

Table 4
Means and standard deviations (SD) for percentage separable components of raw retail cuts from the beef chuck

| Retail cut name | UPC ^a | n | Lean (%) | | Seam fat (%) | | Connective tissue (%) | |
|-----------------------|------------------|----|----------|------|--------------|------|-----------------------|------|
| | | | Mean | SD | Mean | SD | Mean | SD |
| Brisket flat half | 1623 | 10 | 89.68 | 4.92 | 9.26 | 5.45 | 0.00 | 0.00 |
| Brisket point half | 1628 | 10 | 70.66 | 5.59 | 29.23 | 5.53 | 0.00 | 0.00 |
| Shoulder (clod) roast | 1132 | 20 | 95.00 | 2.14 | 1.08 | 1.51 | 3.05 | 1.44 |
| Shoulder (clod) steak | 1133 | 20 | 97.09 | 1.33 | 0.62 | 0.48 | 1.42 | 0.75 |
| Country-style ribs | | 20 | 76.58 | 3.87 | 17.83 | 5.18 | 4.67 | 3.29 |
| America's roast | | 10 | 83.55 | 6.10 | 11.65 | 5.55 | 4.21 | 1.45 |
| Chuck-eye steak | 1102 | 20 | 76.33 | 3.08 | 19.21 | 3.84 | 3.38 | 2.51 |
| Under blade roast | 1151 | 9 | 82.03 | 5.31 | 14.36 | 5.53 | 2.78 | 2.69 |
| Under blade steak | 1158 | 10 | 84.68 | 5.85 | 13.30 | 5.69 | 1.31 | 0.91 |
| Top blade steak | 1144 | 10 | 86.16 | 3.71 | 0.82 | 0.84 | 12.11 | 2.95 |
| Mock tender steak | 1116 | 20 | 95.96 | 1.90 | 0.68 | 0.82 | 2.02 | 0.96 |
| Short ribs | 1127 | 10 | 79.75 | 3.89 | 14.54 | 4.27 | 4.95 | 3.24 |

^aUniversal Product Code

Table 5
Means and standard deviations (SD) for percentage separable components of cooked retail cuts from the beef chuck

| Retail cut name | UPC ^a | n | Lean (%) | | Seam fat (%) | | Connective tissue (%) | |
|-----------------------|------------------|----|----------|------|--------------|------|-----------------------|------|
| | | | Mean | SD | Mean | SD | Mean | SD |
| Shoulder (clod) roast | 1132 | 20 | 94.92 | 1.69 | 0.95 | 1.64 | 4.02 | 2.25 |
| Shoulder (clod) steak | 1133 | 20 | 98.30 | 0.66 | 0.38 | 0.44 | 1.22 | 0.47 |
| Country-style ribs | | 20 | 76.03 | 5.72 | 20.52 | 4.87 | 3.06 | 1.58 |
| America's roast | | 20 | 88.74 | 3.18 | 9.85 | 3.95 | 0.91 | 2.31 |
| Chuck-eye steak | 1102 | 19 | 77.50 | 5.02 | 20.75 | 5.01 | 1.27 | 1.04 |
| Under blade roast | 1151 | 10 | 80.89 | 6.34 | 18.19 | 6.49 | 0.64 | 0.78 |
| Under blade steak | 1158 | 10 | 83.67 | 2.85 | 15.83 | 2.91 | 0.29 | 0.59 |
| Top blade steak | 1144 | 10 | 86.32 | 4.53 | 2.47 | 4.68 | 10.70 | 4.30 |
| Mock tender steak | 1116 | 20 | 97.49 | 1.02 | 0.76 | 0.42 | 2.26 | 0.90 |
| Short ribs | 1127 | 20 | 77.33 | 6.71 | 19.44 | 6.41 | 2.97 | 1.68 |

^aUniversal Product Code

Table 6
Means and standard deviations (SD) for percentage total chemical fat, moisture, protein, and ash (separable lean only) for raw retail cuts from the beef chuck

| Cut name | UPC ^a | n | Total fat (%) | | Moisture (%) | | Protein (%) | | Ash (%) | |
|-----------------------|------------------|------------|---------------|-------------|--------------|-------------|--------------|-------------|-------------|-------------|
| | | | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Brisket flat | 1623 | 10 | 4.20 | 1.30 | 75.54 | 1.23 | 21.91 | 0.42 | 1.24 | 0.05 |
| Shoulder (clod) roast | 1132 | 20 | 3.90 | 1.07 | 73.98 | 1.13 | 21.48 | 0.69 | 1.43 | 0.27 |
| Beef for stew | 1727 | 20 | 3.33 | 1.01 | 74.60 | 1.06 | 21.78 | 0.52 | 1.37 | 0.01 |
| Denver cut | | 10 | 8.99 | 2.68 | 70.44 | 2.47 | 19.02 | 1.71 | 1.05 | 0.07 |
| Country style ribs | | 20 | 7.21 | 1.91 | 71.28 | 1.85 | 20.11 | 0.71 | 1.11 | 0.10 |
| America's roast | | 10 | 6.00 | 2.52 | 72.59 | 2.28 | 20.80 | 1.80 | 1.11 | 0.14 |
| Chuck-eye steak | 1102 | 20 | 8.02 | 2.22 | 70.11 | 1.88 | 20.50 | 1.12 | 1.02 | 0.04 |
| Under blade roast | 1151 | 10 | 5.97 | 1.95 | 72.46 | 2.18 | 20.67 | 19.99 | 1.20 | 0.11 |
| Top blade steak | 1144 | 10 | 6.37 | 1.93 | 73.41 | 1.90 | 19.99 | 0.73 | 1.37 | 0.60 |
| Mock tender steak | 1116 | 20 | 3.39 | 1.03 | 75.20 | 1.02 | 21.26 | 0.56 | 1.40 | 0.28 |
| Short ribs | 1127 | 10 | 10.64 | 3.44 | 69.89 | 22.86 | 19.17 | 0.99 | 1.07 | 0.10 |
| Chuck average | | 160 | 6.18 | 2.40 | 72.68 | 2.05 | 20.61 | 0.98 | 1.22 | 0.15 |

^aUniversal Product Code

Table 7
Means and standard deviations (SD) for percentage total chemical fat, moisture, protein, and ash (separable lean only) for cooked retail cuts from the beef chuck

| Cut Name | UPC ^a | n | Total fat (%) | | Moisture (%) | | Protein (%) | | Ash (%) | |
|-----------------------|------------------|------------|---------------|-------------|--------------|-------------|--------------|-------------|-------------|-------------|
| | | | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Shoulder (clod) roast | 1132 | 20 | 7.34 | 3.06 | 60.73 | 2.77 | 32.01 | 2.03 | 2.88 | 1.01 |
| Shoulder (clod) steak | 1133 | 20 | 5.67 | 1.69 | 65.32 | 2.14 | 28.21 | 1.43 | 1.52 | 0.32 |
| Beef for stew | 1727 | 20 | 5.76 | 1.77 | 61.22 | 1.41 | 33.12 | 1.32 | 1.70 | 0.47 |
| Denver cut | | 10 | 12.65 | 3.96 | 60.97 | 3.29 | 25.20 | 1.93 | 1.09 | 0.11 |
| Country style ribs | | 20 | 11.97 | 3.04 | 58.39 | 2.61 | 28.64 | 1.85 | 1.14 | 0.13 |
| America's roast | | 10 | 9.45 | 3.22 | 65.39 | 3.10 | 25.18 | 1.44 | 1.15 | 0.07 |
| Chuck-eye steak | 1102 | 19 | 10.71 | 2.43 | 62.32 | 2.06 | 26.19 | 1.28 | 1.16 | 0.10 |
| Under blade roast | 1151 | 10 | 10.33 | 3.58 | 58.21 | 3.21 | 30.72 | 2.20 | 1.78 | 0.55 |
| Under blade steak | 1158 | 10 | 9.15 | 2.10 | 59.95 | 2.95 | 30.88 | 2.44 | 1.69 | 0.41 |
| Top blade steak | 1144 | 10 | 8.01 | 2.57 | 64.65 | 3.31 | 26.98 | 3.29 | 1.37 | 0.45 |
| Mock tender steak | 1116 | 20 | 6.10 | 1.93 | 62.29 | 2.82 | 31.23 | 2.77 | 2.40 | 0.69 |
| Short ribs | 1127 | 10 | 14.46 | 4.87 | 56.43 | 4.82 | 27.11 | 1.79 | 0.98 | 0.10 |
| Chuck average | | 179 | 9.30 | 2.85 | 61.32 | 2.86 | 28.79 | 2.86 | 1.57 | 0.57 |

^aUniversal Product Code

Table 8
Least squares means of total chemical fat percentage of separable lean of raw beef retail cuts from the chuck, stratified by USDA quality grade

| Retail cut name | UPC ^a | n | Upper Choice | | Lower Choice | | Select | |
|-----------------------|------------------|----|--------------------|------------------|--------------------|------------------|-------------------|------------------|
| | | | Total fat (%) | SEM ^b | Total fat (%) | SEM ^b | Total fat (%) | SEM ^b |
| Brisket flat | 1623 | 10 | 5.50 ^c | 0.61 | 3.73 ^c | 0.53 | 3.52 ^c | 0.61 |
| Shoulder (clod) roast | 1132 | 20 | 5.04 ^c | 0.27 | 3.81 ^d | 0.24 | 2.88 ^d | 0.27 |
| Beef for stew | 1727 | 20 | 4.02 ^c | 0.35 | 3.44 ^{cd} | 0.30 | 2.51 ^d | 0.35 |
| Denver cut | | 10 | 11.01 ^c | 1.18 | 9.50 ^c | 1.02 | 6.30 ^c | 1.18 |
| Country-style ribs | | 20 | 8.31 ^c | 0.66 | 7.64 ^{cd} | 0.57 | 5.54 ^d | 0.66 |
| America's roast | | 10 | 7.62 ^c | 1.48 | 5.44 ^c | 1.28 | 5.12 ^c | 1.48 |
| Chuck-eye steak | 1102 | 20 | 9.51 ^c | 0.86 | 8.72 ^c | 0.74 | 6.59 ^c | 0.86 |
| Under blade roast | 1151 | 10 | 7.83 ^c | 0.94 | 5.44 ^c | 0.82 | 4.81 ^c | 0.94 |
| Top blade steak | 1144 | 10 | 8.72 ^c | 0.61 | 5.78 ^d | 0.53 | 4.79 ^d | 0.61 |
| Mock tender steak | 1116 | 20 | 4.43 ^c | 0.30 | 3.25 ^d | 0.26 | 2.52 ^d | 0.30 |
| Short ribs | 1127 | 10 | 13.84 ^c | 1.72 | 9.42 ^c | 1.49 | 9.07 ^c | 1.72 |

^aUniversal Product code

^bStandard error of the least squares mean

^{c-d}Means within the same row lacking a common letter differ (P<0.05)

Table 9

Least squares means of total chemical fat percentage of separable lean of cooked beef retail cuts from the chuck, stratified by USDA quality grade

| Retail cut name | UPC ^a | n | Upper Choice | | Lower Choice | | Select | |
|-----------------------|------------------|----|--------------------|------------------|---------------------|------------------|--------------------|------------------|
| | | | Total fat (%) | SEM ^b | Total fat (%) | SEM ^b | Total fat (%) | SEM ^b |
| Shoulder (clod) roast | 1132 | 20 | 10.48 ^c | 0.96 | 6.04 ^d | 0.83 | 5.95 ^d | 0.96 |
| Shoulder (clod) steak | 1133 | 20 | 7.35 ^c | 0.51 | 5.44 ^d | 0.44 | 4.31 ^d | 0.51 |
| Beef for stew | 1727 | 20 | 3.34 ^c | 0.41 | 2.99 ^c | 0.35 | 3.78 ^c | 0.41 |
| Denver cut | | 10 | 15.92 ^c | 2.09 | 11.90 ^c | 1.81 | 10.39 ^c | 2.09 |
| Country-style ribs | | 20 | 13.84 ^c | 1.17 | 11.75 ^c | 1.01 | 10.41 ^c | 1.17 |
| America's roast | | 10 | 12.74 ^c | 1.28 | 9.21 ^{cd} | 1.10 | 6.48 ^d | 1.28 |
| Chuck-eye steak | 1102 | 19 | 12.63 ^c | 0.86 | 11.11 ^{cd} | 0.68 | 8.58 ^d | 0.79 |
| Under blade roast | 1151 | 10 | 12.62 ^c | 2.08 | 9.85 ^c | 1.80 | 8.68 ^c | 2.08 |
| Under blade steak | 1158 | 10 | 9.85 ^c | 1.31 | 9.26 ^c | 1.13 | 8.30 ^c | 1.31 |
| Top blade steak | 1144 | 10 | 10.88 ^c | 1.00 | 7.37 ^{cd} | 0.87 | 6.00 ^d | 1.00 |
| Mock tender steak | 1116 | 20 | 6.93 ^c | 0.71 | 6.58 ^c | 0.62 | 4.62 ^c | 0.71 |
| Short ribs | 1127 | 10 | 19.98 ^c | 1.79 | 13.42 ^{cd} | 1.55 | 10.35 ^d | 1.79 |

^aUniversal Product code^bStandard error of the least squares mean

Means within the same row lacking a common letter (c-d) differ (P<0.05)

Table 10
Cooking yields of beef retail cuts from the chuck

| Retail cut | Cooking method | Cooking yield, % |
|-----------------------|----------------|------------------|
| <i>Braising</i> | | |
| Shoulder (clod) roast | | 64.07 |
| Country-style ribs | | 69.50 |
| Mock tender steak | | 61.68 |
| Short ribs | | 69.50 |
| Under blade roast | | 66.30 |
| Under blade steak | | 65.78 |
| <i>Grilling</i> | | |
| Chuck-eye steak | | 79.21 |
| Top blade steak | | 76.88 |
| Shoulder (clod) steak | | 73.64 |
| <i>Roasting</i> | | |
| America's roast | | 80.72 |

Table 11
 Percentage chemical fat retention for the separable lean
 from cooked beef retail cuts

| Retail cut name | UPC ^a | Percentage fat retention ^b |
|-----------------------|------------------|--|
| Shoulder (clod) roast | 1132 | 120.66 |
| Country-style ribs | | 115.37 |
| America's roast | | 127.13 |
| Chuck-eye steak | 1102 | 105.81 |
| Under blade roast | 1151 | 114.82 |
| Top blade steak | 1144 | 96.72 |
| Mock tender steak | 1116 | 111.09 |
| Short ribs | 1127 | 94.46 |

^aUniversal Product Code

^bValues were calculated using percent cooking yields and
 percentage total fat content of the separable lean for both
 raw and cooked retail cuts

Table 12
Comparison of USDA National Nutrient Database with information from 2005 National Market Basket survey and the current study for total chemical fat of the separable lean in raw retail cuts

| Retail cut name | UPC ^a | TAMU data, 2009 | | Market Basket ^b | | National Database ^c | | Difference ^d (%) | |
|-----------------------|------------------|------------------------|------|----------------------------|------|--------------------------------|------|-----------------------------|--------------------------------|
| | | Total chemical fat (%) | Mean | Total chemical fat (%) | Mean | Total chemical fat (%) | Mean | Market Basket ^b | National Database ^c |
| | | | | | | | | | |
| Brisket flat half | 1623 | 4.20 | | 3.90 | | 5.88 | | +7.69 | |
| Shoulder (clod) roast | 1132 | 3.90 | | 3.96 | | | | -1.52 | -33.67 |
| Beef for stew | 1727 | 3.33 | | 4.26 | | | | -21.83 | |
| Chuck-eye steak | 1102 | 8.02 | | 8.92 | | | | -10.09 | |
| Under blade roast | 1151 | 5.97 | | 7.55 | | | | -20.93 | |
| Top blade steak | 1144 | 6.37 | | 7.32 | | 10.52 | | -12.98 | -39.45 |
| Mock tender steak | 1116 | 3.39 | | 3.23 | | | | +4.95 | |
| Short ribs | 1127 | 10.64 | | 8.40 | | | | +26.67 | |

^aUniversal Product

^b2005-National Beef Market Basket Survey (Mason et al., 2008) data

^cUSDA, National Database data

^dDifference, % = [(TAMU data, 2009 – Market Basket^b) / Market Basket^b]*100; % = [(TAMU data, 2009 – National Database^c) / National Database^c]*100

Table 13
Comparisons of USDA National Nutrient Database with the current study for total chemical fat
of the separable lean in cooked retail cuts

| Retail cut name | UPC ^a | TAMU data, 2009 | | National Database ^b | |
|-----------------------|------------------|---------------------------|-------|-----------------------------------|-----------------------------|
| | | Total chemical fat (%) | Mean | Total chemical fat (%) | Difference ^c (%) |
| | | Mean | Mean | Mean | |
| Shoulder (clod) roast | 1132 | 7.34 | 6.34 | | +15.77 |
| Shoulder (clod) steak | 1133 | 5.67 | 7.66 | | -25.98 |
| Top blade steak | 1144 | 8.01 | 12.79 | | -37.37 |
| Mock tender steak | 1116 | 6.10 | 5.42 | | +12.55 |

^aUniversal Product Code

^bUSDA, National Database data

^cDifference, % = [(TAMU data, 2009 – National Database^c) / National Database^c]*100

APPENDIX B

Beef Nutrient Database Improvement Research Phase I Master Study Protocol

I. Objectives of Research:

To identify and collect beef retail cuts from the beef chuck that need nutrient composition data to be added to or updated in the USDA National Nutrient Database for Standard Reference (SR).

- To generate proximate data for all cuts collected by animal, and prepare samples for further nutrient analysis testing.

II. Research Team:

The research team is led by NCBA Human Nutrition Research staff and includes the following institutions and the each has agreed to take a lead on development of protocol, data sheets and other necessary materials:

- Colorado State University (CSU)
 - a. Cooking of Retail Cuts
 - b. Dissection of Retail Cuts
- Texas A&M University (TAMU)
 - a. Packing Plant Collection
 - b. Fabrication to Retail Cuts
- Texas Tech University (TTU)
 - a. Homogenization/ Aliquots
 - b. Composites/ Samples/ Backups/ Archives

III. Brief Description of the Research:

This research study will involve capturing all of the retail cuts from the beef chuck that have been identified as needing nutrient composition data added to or updated in the SR by NCBA. Three universities (CSU, TAMU, and TTU) will be responsible for identifying and obtaining beef chucks at the packing plant that fit into the study sampling matrix. The universities will assess and record carcass data at the packing plant, properly identify each selected cut and ship the product back to their respective meat laboratories. Next, each university will be responsible for fabricating the product into the needed retail cuts for this study within 14-21 days postmortem. Retail cuts will be properly identified and vacuum packaged and held frozen until cooking or dissection. Each university will be responsible for cooking the retail product according to the study protocol. Cooked and raw product will be dissected and homogenized by each university. Finally, each university will prepare aliquots of each individual sample for proximate analysis and back up. The remainder of the homogenized sample will be shipped to the centralized compositing location, Texas Tech University. Throughout each step of this study the universities will be responsible for following all set study protocols.

- I. Benefits to the Beef Industry:** This research will allow the most accurate beef nutrient data to be available in the (SR), which will have many positive implications for the Beef Industry. First, it will allow for the most accurate nutrient data to be on beef nutrient labels in the meat case which will provide opportunity for on-pack nutrient claims. This research will also provide the nutrient data for beef cuts that are most often marketed in the retail case. Once this data is updated it will allow all other nutrient databases that link to the SR to have the most up-to-date nutrient data which is utilized in nutrition research studies.

II. PACKING PLANT PROTOCOL

a. OVERALL SAMPLING PLAN

- i. Plant – Animal Assignments – see Table 1
- ii. Sampling Diagram – see Table 2
- iii. University Plant Assignments
 1. Colorado State University
 - a. Greeley
 - b. Kansas (Dodge City)
 2. Texas A&M University
 - a. Green Bay
 - b. Tolleson
 3. Texas Tech University
 - a. Plainview
 - b. Nebraska (Omaha)
- iv. Larry Douglass (study statistician) should be aware of when any university is conducting a plant collection in order to be on call for possible changes in the sampling plan.

b. GUIDELINES FOR CARCASS SELECTION

- i. All standard carcass data will be collected on the approved study data sheet for all Quality and Yield Grade factors
 1. USDA Graders categorize carcasses into the official grade categories (Ch, Se, YG2, YG3)
 2. University personnel will make specific quality and yield grade measurements using guided instrumentation
 - a. If university grade assessments disagree with USDA graders then the carcass shall not be selected into the study.
 - b. Call marbling on both sides of the carcass
 - i. Marbling scores shall not cross the grade line (ie: Ch⁻, Ch^{o/+}, Se in order to be selected for this study)
 - ii. Aim to select representative marbling scores within marbling categories
 1. Categories of Choice marbling by % of Choice in market
 - a. 8.8% Moderate
 - b. 26.9% Modest
 - c. 64.2% Small
 2. Categories of Select marbling by % Select in market
 - a. 40% Slight +
 - b. 60% Slight -
 3. University personnel will be responsible for identifying dairy carcasses

- ii. Sort data shall be collected by University personnel so that Vitamin E feeding data can be assessed.
- iii. All animals selected shall be A maturity only
- iv. Carcass weights should fit in the middle of bell-shaped curve as follows:
 - 1.700 – 900 # for steers and dairy carcasses
 - 2.650 – 850 # for heifer carcasses
- v. Carcasses selected for this study shall have hump heights less than 4” measured from the thoracic vertebrae
- vi. Carcasses selected for this study shall be free of major defects
 - 1. bruises, dark cutting, blood splash, callous ribeyes, yellow fat, miss split, etc...
- c. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags
 - 1. Refer to Sample Tag - A
- d. TRANSPORTATION OF CUTS FROM PACKING PLANT TO THE UNIVERSITY
 - i. Each university will make arrangements for proper transportation of selected cuts to their respective meat lab.
 - ii. Considerations
 - 1. Transportation method (ie: refrigerated temperature)
 - 2. Have a log system to verify cuts were at proper temperature when loaded at the plant and upon delivery at the university
- e. STORAGE OF CUTS PRIOR TO FABRICATION
 - i. All cuts shall be stored between in a cooler (0°- 4° C)
 - ii. Proper daily temperature logs shall be maintained by each university to verify their cooler maintained the proper temperature.
 - iii. Fabrication to retail cuts should occur between 14-21 days postmortem.
- f. TRACKING
 - i. The Project Tracking Manager (PTM) shall be notified according to the tracking protocol of the cuts that were selected and the dates of selection, shipping and arrival at the university, along with any data that has been collected.
 - ii. Carcass data shall be entered electronically according to the data entry protocol

III. FABRICATION TO RETAIL CUTS PROTOCOL

- a. Fabrication Protocol to be determined by research team on Feb 27-29 in Lubbock, TX
- b. See Table 3. Phase I Cuts to be Collected and Analyzed
- c. Refer to Chuck Retail Cut Plan and Top Line Sampling documents as a starting point
- d. Notes from November 27-28 meeting
 - i. Start with whole chuck, including Brisket
 - 1. One Chuck for everything but the underblade steak, pot roast and shoulder clod
 - a. Start with shoulder clod and chuck roll – get top blade steak, clod heart, shoulder clod roast and steak
 - b. Stew meat comes from all over
 - c. Shoulder Clod – remove other heads to muscle and turn into stew.
 - d. Out of heart cut 3” roast – comes out to 2.3# for thin cut steaks (3/4”) + one 3” roast
 - 2. It was decided to exclude the Sierra Cut from this sampling plan as it would take multiple Chucks to get enough of this muscle to analyze.
- e. FABRICATION TO RETAIL CUTS TO OCCUR BETWEEN 14 -21 DAYS POSTMORTEM.

- f. PACKAGING OF RETAIL CUTS
 - i. vacuum packaged
 - ii. Bag type:
 - iii. Cryovac machine settings:
- g. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags
 - 1. Refer to Sample Tag - B
- h. HANDLING OF RETAIL CUTS POST-FABRICATION
 - i. All cuts shall FROZEN and stored below -18° C
 - ii. Standardize freeze time for each cut
 - 1. Create the order of which retail cuts will be cooked and dissected first to last and place time limitations on all of these.
 - iii. Proper daily temperature logs shall be maintained by each university to verify their cooler maintained the proper temperature.
- i. TRACKING
 - i. The Project Tracking Manager (PTM) shall be notified according to the tracking protocol of the cuts fabricated and the dates of fabrication, packaging and freezing, along with any data that has been collected.
 - ii. Data shall be entered electronically according to the data entry protocol

IV. COOKING PROTOCOLS

- a. THAWING OF RETAIL PRODUCTS PRIOR TO COOKING
 - i. Retail samples shall be placed in a single layer on trays in a cooler (0°- 4° C) 24 – 32 h prior to sample prep for cooking.
- b. SAMPLE PREPARATION FOR COOKING
 - i. Refer to “NDI Beef Preparation” Protocol
- c. SAMPLE WEIGHTS
 - i. Scale considerations
 - 1. Scale should be on level surface.
 - 2. Level scale
 - 3. Zero before each weight
 - 4. Record weight in appropriate space on approved NDI data sheet
 - 5. Wipe residue from weigh pan after each weight
 - ii. Weigh intact retail cut and record weight on approved NDI datasheet
 - 1. pre-cooked weight
 - 2. post-cooking weight
 - a. rest time before weight recorded
 - 3. Record final internal temperature
- d. COOKING METHODS
 - i. Refer to NDI protocols for broiling, braising, George Foreman grill, pan-broiling, and roasting.
 - ii. Following cooking cuts shall be dissected once they have reached room temperature.
- e. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags
 - 1. Refer to Sample Tag - B

- f. TRACKING
 - i. The PTM shall be notified according to the tracking protocol of the cuts cooked and the dates of cooking, dissection, and homogenizing, along with any data that has been collected.
 - ii. Data shall be entered electronically according to the data entry protocol

V. DISSECTION PROTOCOL FOR COOKED AND RAW PRODUCT

- a. THAWING OF RAW RETAIL PRODUCTS PRIOR TO DISSECTION
 - i. Retail samples shall be placed in a single layer on trays in a cooler (0°- 4° C) 24 – 32 h prior to sample prep for cooking, or dissection of raw product.
- b. SAMPLE WEIGHTS
 - i. Scale considerations
 - 1. Scale should be on level surface.
 - 2. Level scale
 - 3. Zero before each weight
 - 4. Record weight in appropriate space on approved NDI data sheet
 - 5. Wipe residue from weigh pan after each weight
 - ii. Weights to be recorded
 - 1. Intact retail cut sample (cooked/ raw) prior to dissection
 - 2. Subcutaneous fat (external)
 - 3. Seam fat (intermuscular)
 - 4. refuse
 - 5. lean
 - iii. Yield of dissected product
 - 1. 99%-101%
- c. DISSECTION OF THE RETAIL CUT
 - i. Dissect and weigh one sample at a time so that samples will not be mixed
 - ii. Wear latex gloves (no powder)
 - iii. Place dissected lean and fat components in Ziplock bags with proper identification and hold in cooler (0°- 4° C) until homogenization occurs
 - iv. Homogenization should occur in the same day as dissection
- d. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags
 - 1. Refer to Sample Tag - B
- e. TRACKING
 - i. The PTM shall be notified according to the tracking protocol of the cuts cooked and the dates of cooking, dissection, and homogenizing, along with any data that has been collected.
 - ii. Data shall be entered electronically according to the data entry protocol

VI. HOMOGENIZATION/ ALIQUOTS/ PACKAGING/ STORAGE PROTOCOL

- a. SOP FOR HOMOGENIZATION OF BEEF RETAIL CUT SAMPLES
 - i. See official NDI SOP
- b. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags

1.Refer to Sample Tag - C

- c. TRACKING
 - i. The PTM shall be notified according to the tracking protocol of the cuts homogenized and the dates of homogenization, storage in ultra cold freezer, and shipping homogenized sample to TTU for Compositing, along with any data that has been collected.
 - ii. Data shall be entered electronically according to the data entry protocol

VII. SHIPPING FROZEN SAMPLES

- a. SOP FOR SHIPPING OF FROZEN SAMPLES
 - i. See official NDI SOP
- b. KEY CONSIDERATIONS
 - i. When to ship
 - 1.Only Monday – Wednesday
 - 2.No Holidays
 - 3.Consider weather issues that could delay shipment on either end
 - ii. Ship on dry ice in insulated shipping containers
 - 1.Sufficient insulation (ie: paper, stuffing,)should be placed between the samples and the dry ice to avoid freezer burn and cracking of whirl pak bags
 - iii. Notify the receiving lab and PTM in writing (email notification is fine, but be sure they receive it)
 - iv. Recipient of samples
 - 1.Record sample condition upon receipt
 - a. Surface temperature, package damage, late arrival
 - b. Log into inventory
 - c. Send Confirmation of Receipt back to the shipper and cc PTM
 - d. Confirmation should include the condition of the package/ samples upon receipt
 - e. Analytical Labs should provide tracker an estimated time of analysis once samples are received

VIII. PROXIMATE ANALYSIS BY ANIMAL

IX. COMPOSITING

X. DATA QUALITY CONTROL AND DATA TRANSFER PROCESS

- ♦ All data will be entered into a standardized Excel sheet
- ♦ Once data is entered into Excel the data should be printed and cross checked with the hardcopy data
 - If an entry error in the data is discovered
 - Place one line through the data, initial, date and write the correct data to be entered
 - Once a data document is checked and any entry errors are identified
 - Enter the correct data into the excel file
 - Print a new copy

- QC new copy to original hardcopy of data
 - Repeat as many times as necessary
- ◆ Properly back up all data each time the data is updated.
- ◆ All data (packing plant through analytical) including the blind duplicates, control materials should be sent to the NCBA Project Manager and Tracking personnel
- ◆ All data (packing plant through analytical) including the blind duplicates should be sent to the Project Statistician
- ◆ All analytical data including blind duplicates and all control materials (including internal lab control) should be sent to USDA Nutrient Data Lab

XI. STUDY TRACKING

- a. Tracking processes will be established for each step of the study
- b. Each step of tracking will be identified in the study protocols

Beef Nutrient Database Improvement Study Standard Operating Procedure

PACKING PLANT COLLECTION PROTOCOL

1. Purpose:

- 1.1. To describe the procedure for collecting carcasses for the Beef Nutrient Database Improvement Study.

2. Materials

- 2.1. Identification tags, multiple per carcass (See sample tag A), and tagging guns
- 2.2. Data Collection Sheets
- 2.3. Clipboards, Pens, Markers
- 2.4. Fat Depth Probe
- 2.5. Marbling Cards
- 2.6. Ribeye Dot Grid
- 2.7. Refrigerated Truck
- 2.8. Cooler (0-4°C)

3. Procedure

c. GUIDELINES FOR CARCASS SELECTION

NOTE: Two carcasses (A & B) will be selected to fill each of the 36 cells (72 carcasses total)

- i. All standard carcass data will be collected on the approved study data sheet for all Quality and Yield Grade factors
 1. USDA Graders categorize carcasses into the official grade categories (Ch, Se, YG2, YG3)
 2. University personnel will make specific quality and yield grade measurements using guided instrumentation
 - a. If university grade assessments disagree with USDA graders then the carcass shall not be selected into the study.
 - b. Call marbling on both sides of the carcass
 - i. Marbling scores shall not cross the grade line (ie: Ch⁻, Ch^{0/+}, Se in order to be selected for this study)
 - ii. Aim to select representative marbling scores within marbling categories
 1. Categories of Choice marbling by % of Choice in market
 - a. 8.8% Moderate
 - b. 26.9% Modest
 - c. 64.2% Small
 2. Categories of Select marbling by % Select in market
 - a. 40% Slight +
 - b. 60% Slight –

- c. Numeric Scales to be used in the data entry spreadsheet so that the data is ready for analysis
 - i. Marbling Scale: Marbling score should be assessed to the nearest 10.
 - d. Slight 0 - 99 = 300 - 399
 - e. Small 0 - 99 = 400 - 499
 - f. Modest 0 - 99 = 500 - 599
 - g. Moderate 0-99 = 600 - 699
 - ii. Skeletal / Lean Maturity Scale: Assess to the nearest 10
 - a. A 0 - A 99 = 0 - 99
 - iii. Overall Quality Grade Scale:
 - a. Low Select = 1
 - b. High Select = 2
 - c. Low Choice = 3
 - d. Ave. Choice = 4
 - e. High Choice = 5
 - iv. Percentage KPH: enter actual % not the adjustment factor
 - a. 3.5% = 0 adjustment. >3.5% = positive adjustment; <3.5 = negative adjustment

4.5 = +.2

4.0 = +.1

3.5 = 0

3.0 = -.1

2.5 = -.2

3.0 = -.3

2.5 = -.4

2.0 = -.5

1.5 = -.6

1.0 = -.7

0.5 = -.8
- 2. Duplicate carcasses (A&B) shall be selected to be as close in marbling scores as possible (not to cross the grade line). All other characteristics should fall into the outlined criteria.
- 3. University personnel will be responsible for identifying dairy carcasses
- v. Sort data shall be collected by University personnel so that Vitamin E feeding data can be assessed.
 - 1. NCBA will provide a letter that can be used to request this information from the feedlots.
- vi. All animals selected shall be A maturity only
- vii. Carcass weights should fit in the middle of bell-shaped curve as follows:

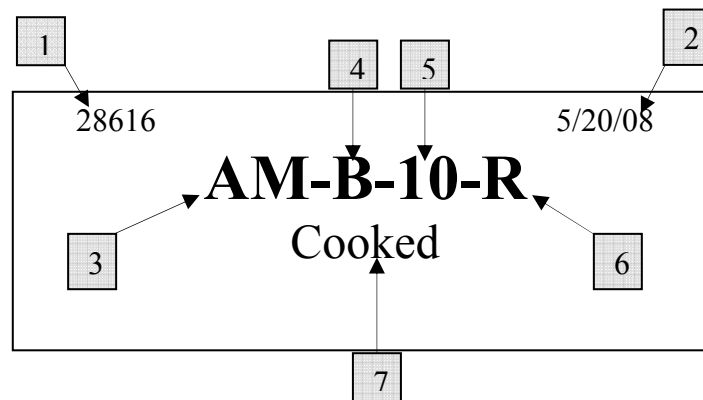
- 1. 700 – 900 # for steers and dairy carcasses
- 2. 650 – 850 # for heifer carcasses

- viii. Carcasses selected for this study shall have hump heights less than 4” measured from the thoracic vertebrae
- ix. Carcasses selected for this study shall be free of major defects
 - 1. Bruises, dark cutting, blood splash, callous ribeyes, yellow fat, miss split, etc...
- d. IDENTIFICATION OF CUTS
 - i. All cuts will be labeled with proper identification tags
 - 1. Refer to Sample Tag – A
- e. TRANSPORTATION OF CUTS FROM PACKING PLANT TO THE UNIVERSITY
 - i. Each university will make arrangements for proper transportation of selected cuts to their respective meat lab.
 - ii. Considerations
 - 1. Transportation method (ie: refrigerated temperature)
 - 2. Have a log system to verify cuts were at proper temperature when loaded at the plant and upon delivery at the university
 - a. Temperature logger should be placed in the muscle of two carcasses during transport to assure temperature was properly maintained.
- f. STORAGE OF CUTS PRIOR TO FABRICATION
 - i. All cuts shall be stored between in a cooler (0°- 4° C)
 - ii. Proper daily temperature logs shall be maintained by each university to verify their cooler maintained the proper temperature.
 - iii. Fabrication to retail cuts should occur between 5-7 days postmortem
- g. TRACKING
 - i. The Project Tracking Manager (PTM) shall be notified according to the tracking protocol of the cuts that were selected and the dates of selection, shipping and arrival at the university, along with any data that has been collected.
 - ii. Carcass data shall be entered electronically according to the data entry protocol on the approved packing plant spreadsheet.

Sample Tag A

Packing Plant ID Tag

1. Project # (28616)
2. Date of Carcass Collection
3. University (AM, CS, TT)
4. Carcass A or B
5. Animal ID # (1-36)
6. Side of Carcass(R/L)
7. Cooked or Raw



**Beef Nutrient Database Improvement Study
Standard Operating Procedure**

CHUCK FABRICATION PROTOCOL

1. Purpose:

- 1.1.** To describe the procedure for fabricating the carcasses for the cuts needed for this study. Fabrication to subprimals shall occur between 4-7 days postmortem. Subprimals will be vacuum packaged and stored without exposure to light at 0-4°C until day 14 postmortem. Fabrication of subprimals to retail portions shall occur between 14-21 days. Retail cuts shall be properly identified, packaged and stored without exposure to light at 0-4°C until day 21 postmortem, and then cuts will be transferred to -18°C storage.

NOTE: All product available from each chuck shall be cut, prepared and packaged to be used as study samples. (ie: The goal is to have at least 2lbs of raw samples, even if it only takes one side of the carcass to achieve this the other side shall also be fabricated and included in the sample)

2. Materials

- 2.1.** Carcass cooler (0°-4°C)
2.2. Daily Temperature Recorder/Logger
2.3. Cryovac Machine and bags
2.4. Post fabrication cuts to be frozen and stored below -18°C

3. Fabrication to Sub-primal weights

- 3.1.** Scale considerations
- 3.1.1.** All scales should be calibrated each day
 - 3.1.2.** Scale should be on level surface.
 - 3.1.3.** **Take weight to the nearest 0.1 kg for subprimal weights**
 - 3.1.4.** Zero before each weight
 - 3.1.5.** Wipe residue from weigh pan after each weight
- 3.2.** Net weights (minus any trolley or lug weights) to be recorded on the Fab to Sub-primal spread sheet
- Whole Chuck (minus trolley weight)
 - Shoulder Clod
 - Chuck Roll 2x3
 - Chuck Short Ribs (1" strips)
 - Boneless Brisket
 - Beef for Stewing
 - Lean trimmings
 - Fat trimmings

- Bone/connective tissue/ non-edible

4. Fabrication to retail cut weights

4.1. Scale considerations

- 4.1.1. All scales should be calibrated each day
- 4.1.2. Scale should be on level surface.
- 4.1.3. **Take weight to the nearest nearest 0.1 g for retail cuts weights**
- 4.1.4. Zero before each weight
- 4.1.5. Wipe residue from weigh pan after each weight

4.2. Net weights to be recorded on the Fab to Retail Cut spread sheet

| <u>Retail Cut</u> | <u>Cooked/ Raw</u> |
|---|--------------------|
| • Beef, Brisket, Falt Half | Raw |
| • Beef, Brisket, Point Half (for dissection only) | Raw |
| • Beef, Chuck, Shoulder Roast | Raw |
| • Beef, Chuck, Shoulder Roast | Braise |
| • Beef, Chuck, Shoulder Steak | Grill |
| • Beef, Chuck, Beef for Stew | Raw |
| • Beef, Chuck, Beef for Stew | Braise |
| • Denver Cut (Serratus Ventralis steaks) | Raw |
| • Denver Cut (Serratus Ventralis steaks) | Grill |
| • Boneless Country Style Beef Ribs | Raw |
| • Boneless Country Style Beef Ribs | Braise |
| • Classic Beef Roast | Raw |
| • Classic Beef Roast | Roast |
| • Chuck Eye Steaks | Raw |
| • Chuck Eye Steaks | Roast |
| • Beef, Chuck, Under Blade Pot Roast | Raw |
| • Beef, Chuck, Under Blade Pot Roast | Braise |
| • Beef, Chuck, Under Blade Steak | Braise |
| • Beef, Chuck, Top Blade steak, Boneless | Raw |
| • Beef, Chuck, Top Blade steak, Boneless | Grill |
| • Beef, Chuck, Mock Tender steak | Raw |
| • Beef, Chuck, Mock Tender steak | Braise |
| • Beef, Chuck, Short Ribs | Raw |
| • Beef, Chuck, Short Ribs | Braise |

5. Fabrication Procedure

NOTE: We will be starting with an intact Beef Arm Chuck. Place it on the cutting table with the superficial side down.

5.1. Remove the **Brisket** (IMPS 120A) by sawing through the costal cartilage and ribs, through the tip of the deep pectoral. Finish the cut by finding the seam and pulling on the posterior end of the brisket and peeling it off of the arm. Clean up the brisket. It should be practically free of deckle fat. (The subprimal will be packaged at this point.)

**[During Dissection we will separate the point half (UPC 1628) and the flat half (UPC 1623) by cutting through the geometric center perpendicular to the length of the brisket. Both are trimmed to practically free.]*

5.2. Break through the feather bones with the saw. Peel them back and remove them.

5.3. Separate the dorsal portion of the cervical vertebrae from the connecting lean to loosen them for neck removal.

5.4. Hang the arm.

5.5. Loosen the ribs from the lean, staying close to the bones. The neck and ribs are removed in one piece.

5.6. Loosen the trapezius to remove the chuck eye roll. The supraspinatus lies just below where the humerus meets the scapula. The latissimus stays on the clod. The deep pectoral wraps around the dorsal side. Continue loosening the trapezius and you'll see the serratus. Pull it off the scapula. Run just along the subscapularis and drop it all off.

5.7. Supraspinatus is removed next to the ridge and torn off. Generate **Mock Tender Steaks** (IMPS 116B, UPC 1116), 1 inch thick.

5.8. Make a mark for the square cut chuck. Cut through biceps close to the humerus. Find the triceps seam and work it up to ensure you get the whole triceps.

5.9. Remove the scapula.

5.10. Take subscapularis off next. Peel it off, but be careful of the teres.

5.11. Remove the Scapula by loosening the connective tissue from the sides, and skin the infraspinatus off the scapula. Loosen the rest of the connective tissue and peel the scapula off.

5.12. Pull off the latissimus dorsi then get underneath the teres and remove it.

- 5.13. Take the infraspinatus off. Watch out for the deltoid, don't take it too. Generate **Top Blade Steaks** (IMPS 114D, UPC 1144), 1 inch thick, starting at the fat end.
- 5.14. Pull the clod. Remove any silver skin and intermuscular fat. Start at the tip of the clod and generate 2 lbs of 1-inch-thick **Beef Shoulder Steaks Boneless** (UPC 1133). From that point, at least 2 **Shoulder Clod Roasts** (IMPS 114A, UPC 1132) about 2-inches-thick will be generated, weighing approximately 2 lbs.
- 5.15. Move on to the chuck roll complex. Once the roll is on the table, remove the ligamentum nuchae, then remove the trapezius. Make the chuck roll a 2X3, which leaves the cut for your **Boneless Chuck Short Ribs** (IMPS 130, UPC 1127). Trim to 75% free from fat. Bisect this cut, parallel to the chuck flap break, leaving two triangle shaped pieces. Cut 1 inch strips from dorsal to ventral, parallel to the chuck flap break, on both pieces, across the grain. Refer to UPC number 117.
- 5.16. Next square off the neck by looking at the exterior surface of the roll (should be looking at serratus and rhomboidius). The serratus and rhomboidius make a sideways "V", at the point where both of those muscles terminate you will square off the neck. Next you can separate the underblade by following the seam between the chuckeye and the underblade. The underblade should be only three muscles (serratus, rhomboidius, and splenius). At the base of the underblade you will see nothing but serratus muscle on the face. Denver steaks are only serratus muscle so therefore you must remove the rhomboidius and splenius. Remove the rhomboidius muscle first, this is the hump muscle. Next remove the splenius by flipping the underblade over so you are looking at the exterior side. The splenius makes a point about 1/2 the length of the serratus, simply score an outline with your knife around the splenius and remove from the serratus by peeling it back (similar to peeling off a flank steak).
- 5.17. Generate **Denver Steaks** (IMPS 116A/E) from the serratus muscle. Cut steaks against the grain, from the firm side (posterior portion). 2 pounds of 1 inch steaks with 0 trim.
- 5.18. For the Chuck Roll, leave adjacent lean on the eye. The first 3 steaks are **Chuck Eye Steaks** (IMPS 116A/E, UPC 1102). Chuck eye steaks may run the length of the LD, and not exceed 1 inch in thickness. Then generate the **Country Style Ribs** (IMPS 116A/D), which are cut 1.5 inches thick, laid over on their sides, and filleted. Finally, generate the **America's Roast, or Classic Beef Roast** (IMPS 116A/D).
 - 5.18.1. The second Carcass is required for the fabrication of the underblade steaks and roasts, outlined below.
- 5.19. Using the second carcass, take the chuck roll complex, remove the underblade from the chuck roll. For the **Underblade Steaks** (IMPS 116A/E, UPC 1158) **and Roasts** (UPC 1151), you will square up the cut (containing the serratus), and take a roast off of each end (2 inch thick), then cut 2 lbs of 1 inch thick steaks out of the middle.

5.20. Beef for Stewing (IMPS 135A, UPC 1727), will be generated as 1 inch cubes with 0 trim. One pound of meat will come from the pectoral muscle and one pound of meat will come from the neck region. Keep large, obvious pieces of CT out of the cube.

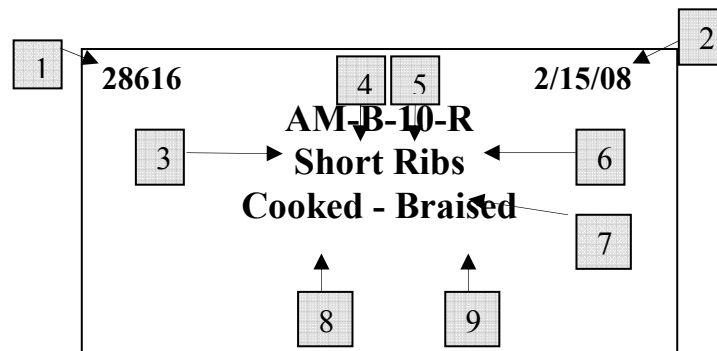
4. Storage and identification

4.1 Following the fabrication of cuts from a carcass, all cuts should be tagged and vacuum packaged, with no administration of heat shrinking. Cuts should be stored without exposure to light until day 21 postmortem between 0-4°C. After day 21 postmortem, cuts shall be stored below -18°C. Transmission properties of the bags used shall be recorded. Proper daily temperature logs shall be maintained by each university to verify cooler maintained proper temperature during storage.

ID TAGS FOR RETAIL CUTS

SAMPLE TAG - B

1. Project # (28616)
2. Date of carcass collection
3. University (AM, CS, TT)
4. Carcass A or B
5. Animal # (1-36)
6. Side of carcass (R/L)
7. Retail Cut name
8. Cooked/ Raw
9. If cooked, cooking method (grilled, roasted, braised)



**Beef Nutrient Database Improvement Study
Standard Operating Procedure**

GRILLING PROTOCOL – DIRECT COOKING

1. Purpose

- 1.1. To describe the procedure for preparing and grilling beef samples

Note: All cooking protocol shall be tested and standardized by each university prior to beginning cooking for this study.

2. Safety

- 2.1. Be careful when handling hot surfaces

3. Materials

- 3.1. Electric grill - Salton Two-sided electric with removable grill plates, Grill Model No. GRP99, Salton, Inc., Lake Forest, IL
- 3.2. Thermometers/thermocouples
- 3.2.1. Type J or K Thermocouple – Calibrate prior to use
- 3.2.2. Type J or K insulated wire
- 3.2.2.1. The thermocouple type and wire type must be the same (ie: if Type J wire is used the appropriate Type J Thermocouple Thermometer must be used)
- 3.2.3. Infrared Thermometer – Grill surface heat detection
- 3.3. Digital Scale
- 3.3.1. Calibrate daily
- 3.3.2. Record to the nearest 10th gram
- 3.4. Beef Samples (Frozen, -20°C)
- 3.4.1. Beef, Chuck, Clod (Shoulder) Steak
- 3.4.2. Beef, Chuck, Chuckeye Steak
- 3.4.3. Top Blade Steak
- 3.4.4. Beef, Chuck, Denver Steak
- 3.5. Stainless steel tongs
- 3.6. Data sheets
- 3.7. Identification tags – Polyester Paper (Xerox Item No. 3R12363)

4. Beef preparation before cooking

- 4.1. Temper frozen raw samples as a single layer in refrigeration (0-4°C) for 24-48 h based

on the appropriate size and weight of the cut; record tempering start and stop date and time, cooler location and temperature of cooler.

- 4.2. Internal temperature of product should not exceed 5°C (for thawed product).
- 4.3. Record raw weight, purge weight, and initial internal temperature of product on Raw Retail Product data sheet prior to grilling.
- 4.4. Using one piece of meat, apply the thermocouple in the geometric center, or thickest portion, of the meat piece. Probe positioning should not affect product's contact with the cooking surface and may not be possible with small or thin beef cuts. In this case, use a thermocouple to periodically check internal temperature of samples throughout the cooking process.

5. Pre-heating

- 5.1. Turn on grill using manufacturer's instructions.
- 5.2. Close grill lid and allow grill to preheat for approximately 10 minutes (all grills must be calibrated and allowed to pre-heat based on each individual grill's warm-up time).
- 5.3. Allow grill temperature to equalize. Check and record heat level using the infrared thermometer – grill surfaces should be approximately 195°C before cooking begins.

6. Cooking

- 6.1. Arrange beef sample(s) evenly spaced in center of cooking grate, with proper identification.
- 6.2. Cook with grill lid closed.
- 6.3. Cook to an internal temperature of 70°C
 - 6.3.1. Use tongs or spatula to remove test samples from grill. Do not use fork.
 - 6.3.2. Record the time and internal product temperature when removed from heat
- 6.4. Allow beef sample (s) to stand while monitoring the internal temperature rise until temperatures begin to decline. The point right before the temperature declines (highest temperature reached) is the final internal temperature of the cooked sample.
- 6.5. Record final internal temperature and the time this temperature was achieved on Cooked Retail Product data sheet.

7. Post-cooking (Stand-time)

- 7.1. Allow beef samples(s) to chill uncovered in refrigeration (2-4° C) for 24 ± 1 hr before dissection.
 - 7.1.1. Assure all ID tags are secure in order to maintain product identification

**Beef Nutrient Database Improvement Study
Standard Operating Procedure**

OVEN BRAISING PROTOCOL

1. Purpose

- 1.1. To describe the procedure for preparing and cooking beef samples

Note: All cooking protocol shall be tested and standardized by each university prior to beginning cooking for this study.

2. Safety

- 2.1. Be careful when handling hot surfaces

3. Materials

- 3.1. Calphalon Everyday Nonstick 6-Quart Dutch Oven (anodized aluminum).

- 3.2. Thermometers/thermocouples

- 3.2.1. Type J or K Thermocouple – Calibrate prior to use

- 3.2.2. Type J or K insulated wire

- 3.2.2.1. The thermocouple type and wire type must be the same (ie: if Type J wire is used the appropriate Type J Thermocouple Thermometer must be used)

- 3.3. Digital Scale

- 3.3.1. Calibrate daily

- 3.3.2. Record to the nearest 10th gram

- 3.4. Beef Samples (Frozen, -20°C)

- 3.4.1. Beef, Chuck, Clod (Shoulder) Heart Roast

- 3.4.2. Beef, Chuck, Stew Meat

- 3.4.3. Beef, Chuck, Country-Style Ribs

- 3.4.4. Beef, Chuck, Underblade Roast

- 3.4.5. Beef, Chuck, Underblade Steak

- 3.4.6. Beef, Chuck, Mock Tender Steak

- 3.4.7. Beef, Chuck, Shortribs

- 3.5. Stainless steel tongs

- 3.6. Data sheets

- 3.7. Identification tags – Polyester Paper (Xerox Item No. 3R12363)

- 3.8. 250 mL graduated cylinder

4. Beef preparation before cooking

- 4.1. Use number of steaks or roasts per trial as specified in test objectives. Prep samples as directed in Beef Retail Cut Preparation Protocol.
- 7.2. Temper frozen raw samples as a single layer in refrigeration (0-4°C) for 24-48 h based on the appropriate size and weight of the cut; record tempering start and stop date and time, cooler location and temperature of cooler.
- 4.2. Internal temperature of product should not exceed 5°C (for thawed product).
- 4.3. Record raw weight, purge weight, and initial internal temperature of product on Raw Retail Product data sheet.
- 4.4. Using one piece of meat, apply the thermocouple in the geometric center, or thickest portion, of the meat piece. Probe positioning should not affect product's contact with the cooking surface and may not be possible with small or thin beef cuts. In this case, use a thermocouple to periodically check internal temperature of samples throughout the cooking process.

5. Pre-heating Dutch Ovens

- 5.1. Use standard-size burner with average wattage or BTU output. (Do not use special feature burners designed for extra-high or low-level cooking.)
 - 5.1.1. Each lab will need to conduct testing prior to actual research study in order to determine the appropriate browning temperature. (Note cooking parameters in data documentation.)
- 5.2. Use medium heat level for browning of product. (Medium heat used for most beef cookery is approximately 177°C (350°F).)
 - 5.2.1. Allow pan temperature to equalize. Check and record heat level using the infrared thermometer – pan surfaces should be approximately 177°C before cooking begins.
- 5.3. Add beef as indicated below in “Cooking.”

6. Cooking

- 6.1. Place beef sample(s) in pre-heated pan and “brown/sear” turning as needed for even browning on all sides. Record time for browning/searing.
- 6.2. Pour off pan drippings. (If applicable for test, measure drippings.)
 - 6.2.1. Measure the volume (mL) of drippings
- 6.3. Using one sample piece of meat (if more than one piece is being prepared in the same Dutch oven at the same time), apply the thermocouple in the geometric center, or thickest portion, of the meat piece. Probe positioning should not affect product's contact with the cooking surface and may not be possible with small or thin beef cuts. In this

case, use a thermocouple to periodically check internal temperature of samples throughout cooking process.

- 6.4. Add a small amount of distilled, deionized water until the water reaches one third-the thickness of the meat. (Record the volume (mL) of water added.)
- 6.5. Increase heat and bring liquid to a boil. Reduce heat to a level to hold liquid at a simmer. (Heat level will vary depending on range unit.)
- 6.6. Cover pan with proper lid.
- 6.7. Place Dutch oven in a preheated 120°C* (250°F) oven, record actual internal oven temperature on data sheet.
- 6.8. Simmer ** and cook until beef samples reach an internal temperature of 85°C.
- 6.9. Remove beef sample(s) from oven keeping thermocouple in probe in place, and monitor temperature rise and decline.
 - 6.9.1. Record the time and internal product temperature when removed from heat
 - 6.9.2. Allow beef sample (s) to stand while monitoring the internal temperature rise until temperatures begin to decline. The point right before the temperature declines (highest temperature reached) is the final internal temperature of the cooked sample.
- 6.10. Record final internal temperature and the time this temperature was achieved on Cooked Retail Product data sheet.

7. Post-cooking (Stand-time)

- 7.1. Remove beef sample(s) from cooking liquid.
- 7.2. Document cooking liquid yield.
 - 7.2.1. Measure the volume of cooking liquid remaining in the pan in mL
- 7.3. Allow beef samples(s) to chill uncovered in refrigeration (2-4° C) for 24 ± 1 hr before dissection.
 - 7.3.1. Assure all ID tags are secure in order to maintain product identification

*Labensky, S. R., A. M. Hause. 2006. On cooking: A textbook of culinary fundamentals. 4th ed. Pearson Education, Inc., Upper Saddle River, NJ.

**General definition of simmering: cooking at a heat level of approximately 85°C (185°F) at which small bubbles just begin to break at the surface of the cooking liquid.

**Beef Nutrient Database Improvement Study
Standard Operating Procedure**

ROASTING PROTOCOL

1. Purpose

- 1.1. To describe the procedure for preparing and cooking beef samples

Note: All cooking protocol shall be tested and standardized by each university prior to beginning cooking for this study.

2. Safety

- 2.1. Be careful when handling hot surfaces

3. Materials

- 3.1. Calphalon Non-stick Roasting Pan w/rack (anodized aluminum – 16 x13 x 4 in.)
- 3.2. Thermometers/thermocouples
- 3.2.1. Type J or K Thermocouple – Calibrate prior to use
- 3.2.2. Type J or K insulated wire
- 3.2.2.1. The thermocouple type and wire type must be the same (ie: if Type J wire is used the appropriate Type J Thermocouple Thermometer must be used)
- 3.3. Digital Scale
- 3.3.1. Calibrate daily
- 3.3.2. Record to the nearest 10th gram
- 3.4. Beef Samples (Frozen, -20°C)
- 3.4.1. Beef, Chuck, American Roast
- 3.5. Stainless steel tongs
- 3.6. Data sheets
- 3.7. Identification tags – Polyester Paper (Xerox Item No. 3R12363)

4. Beef preparation before cooking

- 4.1. Use number of roasts per trial as specified in test objectives. Prep samples as directed in Beef Retail Cut Preparation Protocol.
- 4.2. Temper frozen raw samples as a single layer in refrigeration (0-4°C) for 24-48 h based on the appropriate size and weight of the cut; record tempering start and stop date and time, cooler location and temperature of cooler.

- 4.3. Internal temperature of product should not exceed 5°C (for thawed product).
- 4.4. Record raw weight, purge weight, and initial internal temperature of product on Raw Retail Product data sheet.
- 4.5. Using one piece of meat, apply the thermocouple in the geometric center, or thickest portion, of the meat piece. Probe positioning should not affect product's contact with the cooking surface and may not be possible with small or thin beef cuts. In this case, use a thermocouple to periodically check internal temperature of samples throughout the cooking process.

5. Pre-heating Oven

- 5.1. Position oven rack so that beef sample will be in the center of the oven.
- 5.2. Preheat oven 10 minutes at 160°C (325°F). Assess temperature. Adjust heat level if necessary. Continue to preheat an additional 5 minutes or until desired temperature is reached.
 - 5.2.1. Record actual oven temperature from a calibrated oven thermometer before roasting begins.

6. Cooking

- 6.1. Position beef sample in the center of the rack in the roasting pan.
- 6.2. Do not add oil or water. Do not cover.
- 6.3. Position roasting pan with beef sample on oven rack in center of oven. Roast to internal temperature of 60°C. Observe and record cook temperature and cook time as needed throughout cooking.
- 6.4. Remove beef sample(s) from oven keeping thermocouple in probe in place, and monitor temperature rise and decline.
 - 6.4.1. Record the time and internal product temperature when removed from heat
 - 6.4.2. Allow beef sample (s) to stand while monitoring the internal temperature rise until temperatures begin to decline. The point right before the temperature declines (highest temperature reached) is the final internal temperature of the cooked sample.
- 6.5. Record final internal temperature and the time this temperature was achieved on Cooked Retail Product data sheet.

7. Post-cooking (Stand-time)

- 7.1. Allow beef samples(s) to chill uncovered in refrigeration (2-4° C) for 24 ± 1 hr before

dissection.

7.1.1. Assure all ID tags are secure in order to maintain product identification

Beef Nutrient Database Improvement Study Standard Operating Procedure

RAW AND COOKED RETAIL MEAT DISSECTION

1. Purpose

- 1.1. To describe the procedure for dissection of raw and cooked retail beef products.

2. Safety

- 2.1. Be careful when handling sharp instruments.
- 2.2. Be careful when handling raw product; wash hands thoroughly after dissecting raw product.

3. Materials

3.1. Digital Scale

- 3.1.1. Calibrate daily
- 3.1.2. Weigh to the nearest 10th gram

3.2. Cutting board

3.3. Non-latex, non-powdered, disposable examination gloves

3.4. Disposable scalpels – Fisher Catalog # S17800

3.5. Data Sheets – Raw and Cooked Dissection

3.6. Weigh Boats

3.7. Beef Samples (Raw - Chilled, 2 ± 1 °C)

- 3.7.1. Beef, Chuck, Clod (Shoulder) Roast (U.P.C. 1132) - braised
- 3.7.2. Beef, Chuck, Boneless Country-Style Ribs (New cut) - braised
- 3.7.3. Beef, Chuck, Underblade Pot Roast (U.P.C. 1151) - braised
- 3.7.4. Beef, Chuck, Underblade Steak (U.P.C. 1158) - braised
- 3.7.5. Beef, Chuck, Mock Tender Steak (U.P.C. 1116) - braised
- 3.7.6. Beef, Chuck, Short Ribs (U.P.C. 1127) - braised
- 3.7.7. Beef, Chuck, Clod (Shoulder) Steak (U.P.C. 1133) - grilled
- 3.7.8. Beef, Chuck, Chuckeye Steak (U.P.C. 1102) - grilled
- 3.7.9. Beef, Chuck, Top Blade Steak (U.P.C. 1144) – grilled
- 3.7.10. Beef, Chuck, America's Beef Roast (New cut) - Roasted
- 3.7.11. Beef, Brisket, Flat Half (U.P.C. 1623)*
- 3.7.12. Beef, Brisket, Point Half (U.P.C. 1628)*

* Beef, Brisket, Deckle off, will be frozen whole. Once the brisket is tempered the external fat should be removed to meet the specification of 0" trim fat. The external fat should be saved, packaged and labeled and shipped to TTU for compositing. True dissection of the brisket shall start at the 0" trim level for the Flat half and Point half separately. Please see, "Brisket Special" tab in the dissection spreadsheet for data collection guidance.

3.8. Beef Samples (Cooked - Chilled, 2 ± 1 °C)

- 3.8.1. Beef, Chuck, Clod (Shoulder) Roast (U.P.C. 1132) - braised
- 3.8.2. Beef, Chuck, Boneless Country-Style Ribs (New cut) - braised
- 3.8.3. Beef, Chuck, Underblade Pot Roast (U.P.C. 1151) - braised
- 3.8.4. Beef, Chuck, Underblade Steak (U.P.C. 1158) - braised

- 3.8.5. Beef, Chuck, Mock Tender Steak (U.P.C. 1116) - braised
- 3.8.6. Beef, Chuck, Short Ribs (U.P.C. 1127) - braised
- 3.8.7. Beef, Chuck, Clod (Shoulder) Steak (U.P.C. 1133) - grilled
- 3.8.8. Beef, Chuck, Chuckeye Steak (U.P.C. 1102) - grilled
- 3.8.9. Beef, Chuck, Top Blade Steak (U.P.C. 1144) – grilled
- 3.8.10. Beef, Chuck, America's Beef Roast (New cut) - Roasted

3.9. Identification tags – Polyester Paper (Xerox Item No. 3R12363)

4. Meat Preparation Before Dissection

- 4.1. Temper frozen raw samples as a single layer in refrigeration (0-4°C) for 24 – 48 h based on the appropriate size and weight of the cut.
 - 4.1.1. Record tempering date, start time (military) and location.
- 4.2. Temper cooked samples as a single layer in refrigeration (0-4°C) for 24h post cooking.
 - 4.2.1. Record tempering date, start time (military) and location.
- 4.3. Internal temperature of product should not exceed 5°C (for thawed product).
- 4.4. Weigh intact retail cut sample (cooked/raw) immediately prior to dissection.

5. Dissection

5.1. DISSECTION DEFINITIONS (JONES ET AL., 1992)

- 5.1.1. Refuse (waste): Includes all bone and heavy connective tissue
 - 5.1.1.1. Heavy Connective tissue: connective tissue perceived by trained dissectors as inedible and would eventually be trimmed from a retail cut before being consumed.
- 5.1.2. Lean: to include all muscle, intramuscular fat and any “light” connective tissue considered edible.
- 5.1.3. External Fat: Includes subcutaneous adipose tissue cover located on the outer side of the carcass
 - 5.1.3.1. No external fat will be on the retail cuts at the point of dissection and will not factor into the nutrient profile. However, the external fat from the brisket is to be saved to go into a raw, external fat composite which will be analyzed, but will not affect the nutrient content of any of the cuts in this study.
- 5.1.4. Intermuscular fat: Is the fat depots located within the cut and that may have extended to the outer portion of the cut as a result of fabrication.

5.2. DISSECTION OF THE RETAIL CUT

- 5.2.1. Record the date of dissection
- 5.2.2. Record the start time of dissection for each cut in military time.
- 5.2.3. Dissect and weigh one sample at a time so that samples will not be mixed
- 5.2.4. Wear latex gloves (no powder)
- 5.2.5. Record the initial product weight
 - 5.2.5.1. Raw samples – Post 24-48 h tempering of the raw retail cuts record the raw product weight and the purge weight prior to dissection.
 - 5.2.5.2. Cooked samples – Post 24 h tempering of the cooked retail product, record initial cooked product weight prior to dissection
- 5.2.6. Using the boning knife or a scalpel, separate any connective tissue and intermuscular (seam) fat from the lean of the meat sample.
- 5.2.7. Weigh each component of the dissected retail cut and record.

5.2.8. Place dissected lean components in Ziplock bags with proper identification and hold in cooler (0°- 4° C) for same-day homogenization

5.2.9. Homogenization of the separable lean shall occur the same day as dissection

5.2.10. Dissect fat shall be separated and packaged as follows:

5.2.10.1. Separate samples as follows and vacuum package each sample with proper identification and store frozen (below -18°C) until shipping to TTU where the fat samples will be composited and homogenized.

5.2.10.1.1. External fat – Raw (from Brisket; will not affect nutrient profile of cuts)

5.2.10.1.2. Seam fat – Cooked

5.2.10.1.3. Seam fat – Raw

5.3. WEIGH DISSECTED SAMPLES

5.3.1. Scale considerations

5.3.1.1. All scales should be calibrated each day

5.3.1.2. Scale should be on level surface.

5.3.1.3. Take weight to the nearest 10th of a gram

5.3.1.4. Zero scale before each weight

5.3.1.5. Wipe residue from weigh pan after each weight

5.3.2. Weights to be recorded

5.3.2.1. Purge from raw retail cut packages

5.3.2.2. Intact retail cut sample (cooked/ raw) prior to dissection

5.3.2.3. Lean

5.3.2.4. External (Subcutaneous) fat

5.3.2.5. Intermuscular (seam) fat

5.3.2.6. Refuse (Connective tissue deemed undesirable by trained dissection technician).

5.3.3. Yield tolerance (to be determined and recorded at the time of dissection)

5.3.3.1. 99.0 – 101.0 % recovery tolerance

5.4. IDENTIFICATION OF CUTS

5.4.1. All cuts will be labeled with proper identification tags made from polyester paper

5.4.1.1. Refer to Sample Tag - C

6. Tracking and Tracing

6.1. Dissection data shall be entered into the official NDI dissection spreadsheet according to data entry protocol and forwarded to the Project Tracker and NCBA Project Manager within one week of collection.

ID TAGS FOR DISSECTED AND HOMOGENIZED RETAIL CUTS SAMPLE TAG - C

1. Project # (28616)
2. Date carcass collection
3. University (AM, CS, TT)
4. Carcass A or B

5. Animal # (1-36)
6. Side of carcass (R/L)
7. Primal (Chuck = C)
8. Retail Cut name (see Table 3 for code)
9. Cooked (C) / Raw (R)
10. If cooked, cooking method (G-grilled, R-roasted, B-braised)
11. Purpose (proximate, back up, composite)

28616**2/15/08****AM-B-10-R-C-14SR-C-B****PROX**

Beef Nutrient Database Improvement Study Standard Operating Procedure

HOMOGENIZATION OF BEEF RETAIL CUT SAMPLES

NOTE: All homogenization must be done in the absence of direct light.

1. Purpose

To describe the procedure for preparing and homogenizing raw and cooked beef samples.

2. Safety

- 2.1 Be careful when handling the Robot-Coupe 7 blade-it is very sharp.
- 2.2 Cryogenic gloves, lab coat and safety goggles must be worn when handling liquid nitrogen.

3. Materials

NOTE: All utensils and equipment used in homogenization must be thoroughly cleaned and dried between each sample to assure there is no cross-contamination of materials that would affect nutrient analysis.

- 3.1 Robot Coupe Blixer 7 BX 6V batch processor (M1-45-3) or other approved blending/homogenizing device
- 3.2 **Dissected beef samples to be homogenized – separable lean and separable fat**
- 3.3 Freezer ($-80 \pm 5^{\circ}\text{C}$ ULTRA LOW TEMP)
- 3.4 Digital thermometer (Fisher Cat #15-078J) or equivalent
- 3.5 20 oz Whirl-pak bag – secondary bag (Fisher Cat # B01009WA)
- 3.6 18 oz Whirl-pak bag – primary sample bag (Fisher Cat # B00736)
- 3.7 Gallon size freezer Ziplock bags
- 3.8 11-13/16" Ellipso-Spoon J spatula (Fisher Cat #14-375-57), or equivalent
- 3.9 Permanent, cryogenic marker (Fisher Cat #13-382-52), or equivalent
- 3.10 Teri Wipers (Fisher Cat #15-235-61), or equivalent
- 3.11 Powder-free nitrile gloves (Fisher Cat #18-999-4099), or equivalent
- 3.12 Ice bucket (Insulated bucket capable of withstanding liquid N), at least ~2 quarts size
- 3.13 One (1) medium (7-quart) stainless steel bowl
- 3.14 Cryogenic labels preprinted with sample numbers (Avery #5520), or equivalent
- 3.15 Large siliconized Rubbermaid spatula or equivalent
- 3.16 Analytical balance (M1-39-9 or M1-42-3, Fisher #01-913-317), or equivalent
- 3.17 Liquid nitrogen
- 3.18 Large stainless steel spoon
- 3.19 Safety goggles
- 3.20 Lab coat
- 3.21 Cryogenic gloves
- 3.22 Plastic cutting board

- 3.23 Stainless steel knife
- 3.24 Distribution Form #
- 3.25 Data sheet
- 3.26 Sampling Protocol

4. Procedure

4.1 Prepare for homogenization

Note: It is extremely important to protect the samples from contamination. Do not touch utensils or equipment that comes in contact with the sample. Wear clean, powder-free nitrile gloves when working with utensils, equipment and samples.

- 4.1.1 Adhere a pre-printed label on the outside and at the bottom of the sample baggies.
- 4.1.2 Prepare the station for homogenization. Set out labeled baggies and homogenization utensils.

4.2 Homogenize the sample

Note: Wear powder-free gloves throughout the homogenization procedure.

Note: Always use the same balance throughout the entire procedure.

4.2.1 Raw Samples

- 4.2.1.1 Remove the samples to be homogenized from the -18°C freezer. Allow the samples to thaw in the refrigerator (0°C to 4°C) for 24-48 h. When samples are thawed, the retail cut shall be dissected according to study protocol into separable lean and separable fat. Once dissection is complete, proceed to the homogenization procedure.

4.2.2 Cooked Samples

- 4.2.2.1 Remove the samples to be cooked from the -18°C freezer. Allow the samples to thaw in the refrigerator (0°C to 4°C) for 24-48 h. When samples are thawed, the retail cut shall be cooked according to study protocol. Cooked samples will be tempered for 24 h (0°C to 4°C) prior to dissection into separable lean and separable fat. Once dissection is complete, proceed to the homogenization procedure.

Note: The total time necessary to complete steps 4.2.4 through 5.1 must not exceed two hours. If the time limit is exceeded, notify a supervisor and record the deviation on the homogenizing lab form

- 4.2.3 Following completion of dissection of cooked and raw samples, reserve samples

- 4.2.4 Record starting time on Form.
- 4.2.5 On the plastic cutting board, cut the samples (separable lean or separable fat) into 2.5 cm or less pieces.
- 4.2.6 Pour approximately 1 liter of liquid nitrogen into the ice bucket.
- 4.2.7 Carefully transfer all of the sample from the plastic cutting board to the ice bucket. Carefully stir the sample with a stainless steel spoon to avoid pieces freezing to the bottom and sides of the bucket. Using the stainless steel spoon, check that all of the pieces are completely frozen. If they are not, add more liquid nitrogen in approximately 250 mL increments until the composite is completely frozen.
- 4.2.8 Transfer the frozen sample from the ice bucket into the Robot Coupe 7 bowl. (store bowl in -80 freezer until needed)
- Note: Do not place more than 2500 grams of beef into the Robot Coupe 7 bowl.**
- 4.2.9 Set the speed setting on the Robot Coupe 7 to 1500 rpm. Blend the composite for 10 seconds by turning on the power switch.
- 4.2.10 Remove the Robot Coupe 7 lid and scrape any material adhering to the lid back into the Robot Coupe 7 bowl using the large siliconized Rubbermaid 7 spatula. Scrape the residue off the spatula on the inside of the Robot Coupe 7 bowl. Scrape down the sides of the Robot Coupe 7 bowl using the Rubbermaid 7 spatula. Scrape the spatula on the inside of the Robot Coupe 7 bowl.
- 4.2.11 Blend the sample for 30 seconds at 3500 rpm by turning on the power switch of the Robot Coupe 7.
- 4.2.12 Remove the Robot Coupe 7 lid and scrape any material adhering to the lid back into the Robot Coupe 7 bowl using the large siliconized Rubbermaid 7 spatula. Scrape the residue off the spatula on the inside of the Robot Coupe 7 bowl. Scrape down the sides of the Robot Coupe 7 bowl using the Rubbermaid 7 spatula. Scrape the spatula on the inside of the Robot Coupe 7 bowl.
- 4.2.13 Repeat steps 4.2.12 through 4.2.13. If the contents of the Robot Coupe 7 bowl appear to be homogeneous, proceed to step 4.2.15. Contents should be in fine powdered form free of chunks, etc. If not, repeat steps 4.2.12 through 4.2.13. If needed, store homogenized samples in -80 freezer before analysis.
- 4.2.14 Transfer the contents of the Robot Coupe 7 bowl to a clean medium stainless steel bowl using the large Rubbermaid 7 spatula.

- 4.2.15** Carefully pour approximately 1 liter of liquid nitrogen into the composite to ensure it remains frozen while aliquoting.

NOTE: BEWARE – Pouring too much liquid nitrogen too fast will cause the powdered sample to blow out of the bowl.

- 4.2.16** Using the stainless steel spoon, stir the sample in the following manner; start at the outer edge of the bowl and work toward the center and then back out again in a smooth motion. Repeat the stirring pattern for 30 seconds.

4.3 Aliquot into sample bags for proximate analysis and for compositing.

- 4.3.1** Using the Ellipso-Spoon J spatula, fill an 18 oz Whirl-pak bag with the required amount for sampling – **Record Sample Bag Weights**

4.3.1.1 Proximate analysis = 60 grams

4.3.1.2 Back-up samples = 135 grams

4.3.1.3 Archive samples = 135 grams

- 4.3.2** Make sure there is no sample residue on the opening or on the outside of the baggies. Clean the baggies with a Teri Wiper 7 if necessary.

- 4.3.3** Fold each sample bag and seal. Be sure to press out all air.

- 4.3.4** Place sample bag inside 20oz Whirl-pak bag, fold and seal.

- 4.3.5** Place the remainder of the homogenized sample into a Freezer Ziplock Bag that is properly labeled with the sample identification, remove all air and seal securely. This sample is for compositing and will be referred to as “For Composite”

- 4.3.6** Place “For Composite” sample inside another Ziplock Bag and seal. The “For Composite” sample will be shipped to Texas Tech University for compositing.

4.3.6.1 See NDI Shipping SOP#9

- 4.3.7** Record end time of homogenization of a single animal on the data sheet upon storage

5. Storage

- 5.1 Make sure each bag is tightly sealed. Store the samples in the - 80°C ± 5°C ultra-cold freezer. Record end time on Form

- 5.2 Complete Form

APPENDIX C

Figure 1
Raw beef brisket



Figure 2
Raw beef shoulder clod roast



Figure 3
Raw beef shoulder clod steak



Figure 4
Raw beef for stew



Figure 5
Raw beef boneless country style ribs



Figure 6
Raw beef America's roast



Figure 7
Raw beef chuck-eye steaks



Figure 8
Raw beef under blade roast



Figure 9
Raw beef under blade steak



Figure 10
Raw beef top blade steak



Figure 11
Raw beef mock tender steak



Figure 12
Raw beef short ribs



VITA

Sarah Elizabeth West was born to Ira and Rebecca West. She received her Bachelor of Science degree in animal science with a minor in chemistry and biology from Angelo State University in May 2007. She entered the Meat Science Section at Texas A&M University in June 2007 and received her Master of Science degree in May 2009. Her research interests include nutrition of whole muscle beef cuts, and innovative fabrication techniques of beef retail cuts.

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